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RECENT ADVANCES IN OUR KNOWLEDGE OF POULTRY DISEASES

(Three Lectures at the Imperial College of Science)

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Introduction

The pathology of poultry diseases is usually studied in view of its practical applications; but, apart from such considerations, it deserves to be the object of specialised attention on the part of qualified investigators, for several notable advances in biological knowledge have resulted from experiments and observations on avian material. For obvious reasons, the hen's egg has been a favourite object of embryological study since the time of Aristotle; whilst the original researches of Fabrizio da Acquapendente (1537-1619), and also Morgagni (1682-1771), who accurately illustrated the development of embryo chicks in the egg, helped to solve many problems connected with generation. These early researches in comparative morphological embryology introduced a subject which still affords matter for contemporary investigation. The observations of Darwin in relation to inheritance of characters in pigeons deserve a brief reference; the laws of genetics in plants discovered by Johann Gregor Mendel (1822-1884) were ascertained to be applicable to animals, through experiments on fowls, by Bateson in 1900, and later by Punnett and his collaborators —which experiments, it may be incidentally remarked, have yielded results of practical use in the selection of suitable poultry stock for breeding under farming conditions.

These examples of contributions to science through experimental biology lead to a consideration of the remarkable advances in Medicine and Comparative Pathology which have followed initial researches on birds. The transmission of bird-malaria in sparrows by means of mosquitoes accomplished by Ross (inspired by Manson), may appear somewhat crude in the light of present-day experimental technique, but these studies helped to explain the spread of malaria in mankind. Even in recent times the value of new synthetic drugs for the treatment of ague is tested on canaries infected with *Plasmodium relictum* (Roehl, 1926, and others).

Further, the investigations of Marchoux and Salimbeni (1903), which revealed that spirochætosis in fowls was disseminated by the fowl-house bug, *Argas persicus*, no doubt led to the recognition by Dutton and Todd (1905) of the part played by another tick, *Ornithodoros moubata*, in causing Central African relapsing fever in man. The importance to man and animals of the many tick-borne diseases which have since been discovered is well known. The experiments in the Dutch East Indies of Eijkman (1897 and later), who found that a diet of polished rice produced in fowls a condition of polyneuritis similar to beri-beri (a disease occurring in prisoners fed on the same decorticated grain) are worthy of singular mention, for Gijns, in 1901, showed that this nutritionally-induced polyneuritis in fowls could be prevented by adding a bean, *Phaseolus radiatus*, to the polished rice. Shortly after, Hulshoff-Pol (1902) discovered that this bean acted both as a preventive and curative agent in beri-beri. It will be admitted that these researches induced the discovery of vitamins, and thus opened several broad avenues of research which are still being ardently explored. Lastly, one may mention the accurate studies of Peyton Rous (1910) in relation to his recognition of a filterable "virus" as the cause of a myxo-sarcoma tumour in fowls. This proved an incentive to numerous investigations, whose results, when interpreted in combination with experiments on other animals, we hope may yet elucidate the obscurities surrounding the cause of cancer in man and animals. These few examples suffice to show that there is full justification in pursuing poultry pathology for its intrinsic interest, since in the past it has proved a fruitful field for research, leading to an ever-widening expanse of knowledge.

Reverting to the so-called practical aspects of poultry pathology, it is not difficult to demonstrate its importance in agriculture. It is common knowledge that the total value of eggs and poultry imported into this country is far superior to what it ought to be, or, in other words that, given the facilities already in existence, Great Britain could be self-supporting in relation to poultry. The causes of this adverse balance are partly known and also to a certain extent generally recognised, though it is a subject the many implications of which cannot be dismissed in a few words. Nevertheless, one may say that the spread of preventable diseases, with their heavy recurring mortality, followed by the

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attendant evils of low hatchability and inferior egg yield, are the principal causes of losses on farms all over the country; losses which may be tragically ruinous for the individual concerned.

It can be stated that the immediate etiology of nearly all, if not all, the most important or dangerous ailments of the domesticated fowl has been recognised and that therefore the application of this knowledge to the treatment and prevention of poultry diseases is a matter of progressive research; so that one may justly plead for the specialised study of poultry pathology and medicine by suitably qualified investigators, to a greater extent than at present.

Before proceeding further, I should like gratefully to acknowledge the aid afforded by the trustees of the Plimmer Fellowship in the prosecution of the researches to which these lectures refer, and particularly to express my appreciation of the kind interest of Professor V. H. Blackman, F.R.S., who has enabled me to address you on what I deem to be an important subject and one which deserves to be investigated in correlation with other branches of Comparative Pathology.

MANAGEMENT AND NUTRITION IN RELATION TO THE PATHOLOGY OF FOWLS

It is a general rule that treatment and prevention should be based on a thorough recognition of the development and causation of any morbid condition. Such knowledge is particularly essential in dealing with poultry ailments, where, in many instances, expectant individual treatment, which plays such a great part in medicine, is economically unprofitable and practically unjustifiable, for reasons which can be explained.

It is my considered opinion that, given suitable feeding and management, there is no fundamental reason why the domesticated fowl should be more subject to disease than any other productive farm animal.

Admittedly the housing and feeding of fowls differs considerably from that of sheep or pigs, for example; in addition, egg production represents a considerable strain on the hen. Nevertheless, experience and experiment teach us that in such matters it is simply a question of adapting certain axiomatic principles of hygiene to particular instances. Since in the rearing of fowls, free-range, semi-intensive and full intensive methods are employed, one may well consider whether these radical differences in management influence the well-being and illness of domesticated fowls.

Several text-books on poultry management can inform us how these methods differ in relation to the general health of poultry; on the other hand, one does not meet with reasoned explanations, setting forth how management and nutrition influence not only the disease which may develop in any stock of fowls, but also the extent and intensity of the infection.

The ailments and parasitic infestations which have been chosen as a subject for these lectures should illustrate this alteration of disease as the result of nutrition, the consideration of which in the study of the pathology of fowls I deem important. When viewed from the standpoint of the pathologist, it is evident that the full free range method will supply the greater variety of diseases, though not the largest incidence; for free-range fowls can be noticed to be particularly resistant to the depredations even of a mass attack by parasites. It is in the semi-intensive birds that, as a rule, the effects of parasitism are found to be more marked and far-reaching. To give a concrete example: cæcal coccidiosis, which will cause a relatively negligible mortality in full free-range pullets, say to the extent of 10-15 per cent., will induce quite a heavy death and invaliding rate in semi-intensive birds. As to the fully-intensive fowls, it can be said that parasites do not play a great part in their pathology, unless by some mischance a heavy source of infestation is introduced; for example, a coccidia carrier, when the result may be disastrous owing to facilities for reinfection; the same applies to fowl-pox and canker. Here, on the other hand, numerous nutritional disturbances may make their appearance, beginning with feather picking and/or cannibalism; these will spread rapidly, followed by mortality due to a variety of seemingly unrelated causes, but which, to my mind, are rooted in nutritional deficiencies, particularly at an early age.

It is on such large intensive poultry farms that the effects of nutrition on pathology become more clearly evident, and where it can be shown how the type of any epizoötic is determined by the method of management employed. It is not only a case whether or not the birds are going to be affected to the extent of 9 per cent. or 99 per cent. by any disease introduced, for the percentage between these two extremes is greatly influenced by the extent of propinquity or crowding together; it is also a matter not unrelated to the hygienic precautions taken once the disease has been detected. But in addition to all this, one must consider what the rate of recovery is going to be; that is, whether the scourge is going to sweep nearly all your stock into the incinerator, except for a few stunted specimens, or leave a fair number of passably useful survivors. It is this useful survival rate which is so clearly dominated by the feeding previous to and during the outbreak.

So far pullets and hens have been considered, but feeding is equally extremely important in

relation to life and health of chicks. In chicks up to a fortnight old, there can be little hesitation in stating that numerous necropsies show but too clearly that the feeding of the mother hen makes itself noticeable in the first fortnight of the chick's life, not only in the rate of resorption of the yolk but also in its suitable assimilation. Much of the mortality which is now labelled as due to chills, can be seen to be the effect of errors of nutrition in the parent hen.

In discussing these matters as a pathologist, I am fully aware of the great individual variations in virulence between individual strains of germs of the same species and the resulting different aspects of disease. The existence of harmless microbes, or of such as may even be beneficial, from the human point of view, is also admitted. The rule I am trying to explain is that when dealing with infectious diseases or the effects of parasitism in poultry the effects of errors of nutrition are reflected in increased invaliding and mortality, though the virulence of the particular causative disease germs is not influenced; the seed being the same, the soil is more suitable.

Experience and experiment agree in showing the hygienic value of good food and proper management in maintaining the health and well-being of most animals; such preventive conditions influence the domesticated fowl even more than other farm animals. The reason for this, it may be suggested, is found in the rapid and intensive metabolism of the hen, its large output of nutritive substances through the egg, its relatively short, and what one may rightly call "super-charged" existence. The subject of poultry hygiene possesses sufficient practical importance to bear repetition when discussing the part played by vitamins, in successful poultry farming under differing conditions, in another lecture.

Having stated the importance of food and farming conditions in their relation to the spread of disease and the extent of mortality in poultry, it is not feasible to approach and exhaust the subject of suitable nutritional formulas for different stages and conditions of poultry. This particular matter is instead adequately considered in the relative Bulletin of the Ministry of Agriculture, and also elsewhere. In such publications the principles underlying the suitable nutrition of fowls are fully discussed and the intelligent and practical reader will be able to form his opinion as to which are the necessary constituents of a correct feed for poultry.

THE MINUTE DUODENAL TAPEWORM, *DAVAINEA PROGLOTTINA*

This is taken as the first example, not only because pathogenic effects of this cestode are evident throughout the length and breadth of the land, but because quite recent experimental work has enabled us to gain a complete view of its life cycle and the means of dealing with this parasite; this work I am able to confirm, having repeated it.

This cestode was originally described from fowls in France by Davaine in 1860, though it had been previously illustrated by Dujardin in 1843. That its intermediary host might be a slug was originally suggested by Grassi and Rovelli in 1888; these zoologists, however, admitted that they had been unable to control their experiments with due care, but identified the slugs *Agriolimax agrestis*, *Limax cinereus* and *L. flavus*. Since then transmission has been successfully accomplished by Chandler (1923) in relation to *Agriolimax agrestis* in the United States. Later Wetzel (1932) published a complete study of the subject and succeeded in proving under accurate experimental conditions the transmission of this cestode by means of the slugs mentioned by Grassi, and, in addition, by the snails *Arion empiricorum*, *A. hortensis*, *A. circumscriptus*, *A. intermedius* and *Cepea nemoralis*. These results were repeated in the Molteno Institute, in part by F. J. Brown (1933), and later by myself. Slugs (*Agriolimax agrestis*) collected in a field where no hens were present, were fed on washed-out proglottids of Davainea and kept for three weeks on wet blotting paper in glass dishes and fed on chopped cabbage; mortality was heavy, but a few survived long enough to develop mature cysticercoids, and these were fed to two nine week-old laboratory-bred pullets; within three weeks one showed three and the other 22 mature Davaineæ in the duodenum.

These are the positive results; there were also numerous failures extending over months of work, due to the difficulty of keeping slugs alive under laboratory conditions and to the possibility that young chicks four to five weeks old, which we at first tried, do not allow the tapeworm to develop.

Incidence in Great Britain.—This small cestode has been recorded nearly everywhere where fowls are kept, which means a large part of the inhabited globe. More particularly in relation to Great Britain, I have received fowls harbouring this tapeworm from Scotland, England, Wales, and also from a farm in Northern Ireland. The general incidence varies greatly between one farm and another, even when they are closely situated; it may also vary between pens on the same farm. This can be explained by the fact that the tapeworm cannot be transmitted except through the intermediary of a slug; direct transmission does not take place. Where slugs are numerous, the chances for infestation are greater, so that as many as eleven fowls out of every twelve will harbour the parasite. The infestation is more frequently noticed in the late summer, say from August to

October, when as many as 40 per cent. of the necropsies performed on free-range birds may exhibit this worm, whilst in the early spring the proportion may fall to 15-20 per cent. The yearly average is approximately 20 to 25 per cent. As to the numbers present in fowls, they may vary—a light infestation would number 25-30 worms; the average is a couple of hundreds; whilst heavy infestations, with 2,000-3,000 worms, which spread to the ileum, have also been seen in our necropsies, but are uncommon. *Davainea proglottina* has been observed in turkeys, but otherwise it appears to be restricted to the domesticated fowl.

Pathogenic Reaction Induced by Davainea proglottina.—The experimental effects of infestation by this tapeworm are still being studied, so that the present remarks are the result of field observations extending over several years, to be exact, since 1927. Different authors mention emaciation, enteritis, mortality; on some farms I have noticed the frequent incidence of a peculiar form of progressive anæmia (erythromyelosis), accompanied by heavy infestation with this cestode. Its connection with fowl-paralysis or neuro-lymphomatosis has been often surmised but never conclusively proved.

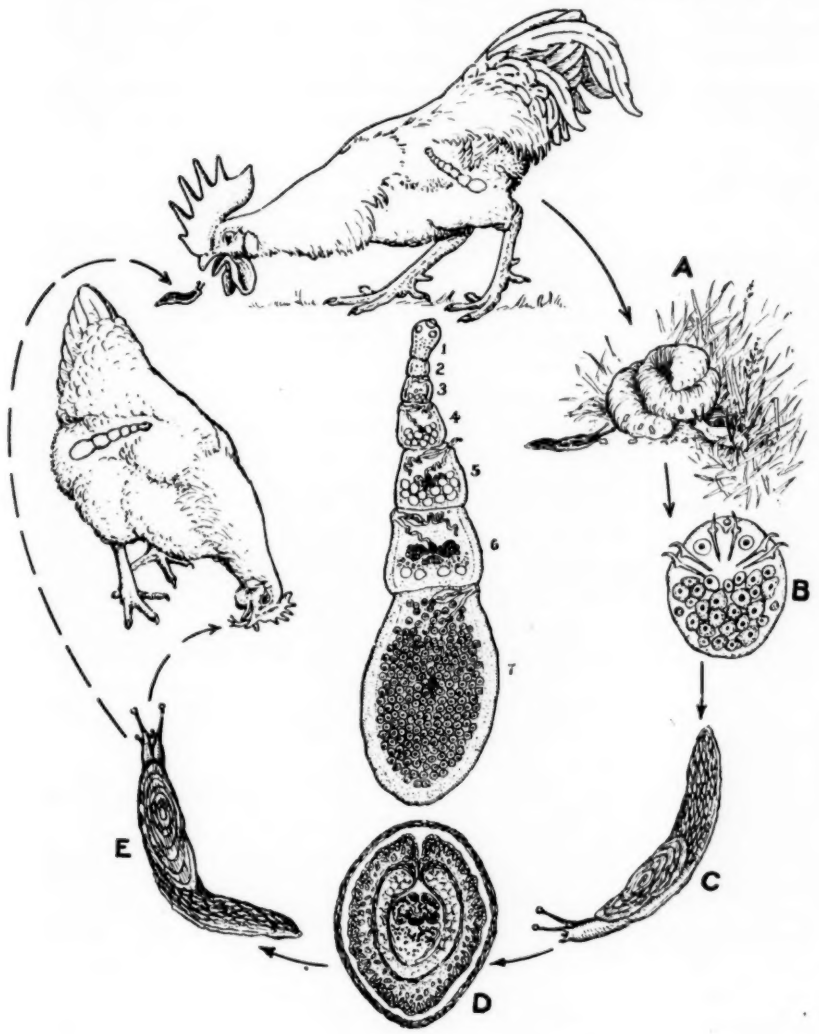
It must be evident from the manner in which the cestode is firmly anchored in an important part of the digestive tract that it cannot fail to be harmful, even if only as a mechanical stimulus; indeed, one usually finds damaged villi, cellular infiltrations and small hæmorrhages in the neighbourhood of the tapeworms. The mechanical irritation may well be enhanced by the action of hypothetical toxins or similar bodies excreted by the worm, but this is not positive knowledge. What I can assert is that I have not met a fowl with a heavy infestation whose egg-laying performance was satisfactory. In relation to this tapeworm the effect of nutrition can become very manifest; for on farms where the mash is rich, the fowls remain fat and in flesh, though their egg yield is low. On other farms, where the feeding formula is poor, dimagration and anæmia made their appearance in company with the tapeworms. It may, of course, be said that the food or the tapeworms alone are the cause of the morbid condition. Against this view one can adduce further evidence to the effect that on farms where these conditions occurred, an alteration did not take place not only till the foodstuff formula was radically changed, but, in addition, the fowls were removed away from the fields which, owing to their moist condition, were more heavily visited by slugs.

Morphology.—The tapeworm consists of a club-shaped head or scolex, in which one can detect a slender retractile process or rostellum armed with 50 or 60 hooks. In addition, there are four circular suckers, on the edges of which two irregular rows of hooklets can be detected. The rostellum is fully extruded when the worm is fixed to the bowel. The scolex exhibits a constricted neck, to which the jointed body is attached; this consists of five to seven (or even more) segments or proglottids, the first two of which are usually undifferentiated; the others contain male and female generative organs, the genital opening being alternatively placed left or right. In the second or third segments the male gonads are clearly noticeable, whilst from the fourth and fifth the ♀ organs predominate, consisting of vitellarium, two ovaries, receptaculum seminis and vagina (no uterus). In other proglottids the ova and shelled embryos or onchospheres usually predominate to the extent of completely filling the segment. Such ripe proglottids separate easily from the parent tapeworm and are carried out with the waste products of digestion. When they reach the exterior with the fæces, these proglottids are seen to be actively movable, but a slight pressure will cause them to burst and extrude the onchospheres; these are also capable of active movements and rhythmically extrude and retract their fine sickle-shaped six hooklets in pairs. Except in very heavy infestations, when the cestode may be found in the first few inches of the ileum, the parasite is restricted to the duodenum.

Life Cycle in the Slug Agriolimax agrestis.—It is thought that the proglottids move actively away from the fæcal mass and are then ingested by a slug, of which the commonest variety in Great Britain is the little brown field slug. Other slugs are also capable of acting as intermediate hosts, but *Agriolimax agrestis* is one with which I have experimented, following the excellent work of Wetzel (1932), who worked out the whole cycle very thoroughly in several different slugs. The brown slugs devour the proglottids quite readily, and the outer covering of the proglottid being disintegrated, the onchospheres are liberated and penetrate the walls of the intestine, where they encyst, cover themselves with a coating and develop into a cysticercoid, in which the rostellum and armed suckers, described in the adult scolex, can be detected in a rudimentary form. These cysticercoids appear as globular structures on the wall of the digestive tract of the slug and take about two to three weeks to reach maturity, much depending on the outer temperature. As many as 100 or 150 cysticercoids may be noticed in a single slug. On the slug being picked up by a fowl, the encysted cysticercoids are liberated in the gizzard and then implant themselves firmly in the villi of the duodenum, where they mature within a fortnight.

Habits of the Slug.—It has often happened that " no slugs " have been reported on farms, which meant that they could not be seen during

THE TAPEWORM'S LIFE-CYCLE



1-7. Tapeworm *Davainea proglottina.*

1. Scolex or head with suckers and hooks.

2-3. Undifferentiated segments.

4-5-6. Segments with male and female generative organs.

7. Mature segments or proglottids with eggs; these drop off at intervals and carry on the infestation.

A. Droppings with proglottids which crawl out and are being eaten by slugs.

B. Small embryo (oncosphere) armed with six hooks.

C. Slug containing oncosphere which develops into—

D. encysted shape which forms in the slug and is eventually eaten by a fowl and develops into a fully grown tapeworm *Davainea proglottina.*

From Bayon's "Diseases of Poultry," sketch by Mr. Bruff Jackson, adapted from Wetzel (1932). Reproduced by courtesy of "The Feathered World."

the day. Slugs crawl out of their hiding place under flat stones, boards, etc., when the dew is moist on the grass; they are also night feeders. The life of a slug, under natural conditions, is considered to average a year; obviously slugs may live three weeks or more with extremely heavy infestations of the digestive tract by the cysticercoids of *Davainea proglottina.* Still, one cannot believe otherwise than that heavy infestations of the alimentary canal must shorten the life of slugs and that accordingly, as a practical consideration, it may be safe to place fowls again on a field in which infected slugs are known to be present, once carrier hens have been kept away for a year.

Proportion of Infected Slugs.—On a particular patch of ground on a farm, where eleven out of every twelve hens showed heavy infestations with Davainea, an examination of three hundred slugs, in batches of 50 at a time, revealed cysticercoids in 3 to 5 per cent. If these figures, which could be confirmed on other farms, represent the usual rate of infestation, then it seems as if hens, to become heavily infested, must eat several hundred of slugs; since a slug cannot find room for more than a couple of hundred cysticercoids, and hens we have seen may harbour as many as 2,000 to 3,000 tapeworms. It cannot be doubted that slugs represent a desirable tit-bit for fowls, and therefore one may wish to find means of clearing out the Davainea and yet leave the birds to the enjoyment of juicy slugs, if it can be safely done.

Individual Treatment of Fowls.—For the purposes of diagnosis on the living fowl the ripe proglottids can be washed out of the droppings by means of tap water in a glass bowl and then picked out with the aid of a lens; this course may be recommended where it is intended to send valuable birds to a laying test or abroad. It should be noted that there appears to be a peculiar cycle in the passage of the worm-segments, which are more frequently voided in the afternoon; possibly increased secretion from the duodenum may be connected with this

periodicity, which has been first noted by Wetzel (1932). If proglottids are found in the droppings, the fowl should be kept in a coop and treated with an emulsion of equal parts of turpentine and olive oil, which can be given by means of a graduated pipette; two cubic centimeters will suffice for an average-sized adult fowl. This treatment can be repeated at a week's interval, but it must be understood that it is of no avail if the birds are allowed to go back to a slug-ridden piece of land and thus are given the chance of re-infecting themselves.

How to Root out the Infestation; Control and Prevention.—The most suitable point of attack for this purpose is the slug, and though its presence in chicken runs is difficult to avoid, yet numbers can be considerably reduced by means of a heavy sprinkling of lime on ground; the fowls should not be allowed on the run thus treated till the lime has had time to settle completely, usually three to five days. Another method consists in scattering a mixture of one part of bluestone ($CuSO_4$) to five parts by weight of sand.

The problem can also be approached by shutting up the hens known to be carriers of the tapeworm, treating them as previously suggested and not using the slug infested ground for a year, by which time it is to be expected that the slugs with cysticerci will have died out.

In practice it has been found that slugs and tapeworms can be reduced only by a combination of the methods recommended.

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Research on "Fowl-paralysis" and Allied Conditions

The mortality attributed to the disease commonly known as fowl-paralysis has been very large during the last few years in Great Britain: many poultry farmers report losses amounting to several hundreds of hens, or corresponding to 50 or 60 per cent. of their stock. The investigation of such outbreaks was begun in 1930, and has been continued since, particularly by following the course from the early inception of the disease; such consistent observation has revealed often that where such heavy mortality was occurring, either the diagnosis "fowl-paralysis" was incorrect or solely applicable to a small minority of birds; the death of the others could then be definitely traced to coccidiosis, tuberculosis, tapeworms, to such causations as chronic poisoning through corrosive chemicals added to the drinking water in the hope of stopping coccidiosis, or again to acute infectious diseases like tracheal roup. It could be ascertained, moreover, that the type of fowl paralysis which is diagnosable as "neuro-lymphomatosis" exhibits distinct pathological characters and can be influenced by treatment, whilst the forms due to coccidia or other parasites or complicated by their occurrence are not so amenable. Not only this, but that neural lesions induced by coccidia or tapeworms could be microscopically distinguished from those of neuro-lymphomatosis.

It is intended to adduce evidence for these statements, with due consideration of the research performed by various investigators; for sharply contradictory opinions are still held regarding the etiology of the distinct ailment designated as neuro-lymphomatosis gallinarum, though it exhibits relatively constant pathological signs and lesions. The historical development of the knowledge of this disease has been ably reviewed by Biely and Palmer (1932) in the *Veterinary Record*, October 29th, so that a few brief notes will now be sufficient. Instead, the morbid tissue alterations occurring in neuro-lymphomatosis will be compared with those detected in somewhat similar conditions of fowls; followed by a critical discussion of the various theories relative to the etiology of "fowl-paralysis" on the basis of personal observation and experiment.

HISTORICAL SUMMARY

Whilst there appears to be good reason to believe that various forms of paralysis in fowls have been observed in the past, yet the first to recognise a definite and distinct type of the ailment was Marek (1907) in Hungary, who described a form of paralysis in fowls different from that occurring as the result of prolonged feeding with decorticated rice and which eventually was known as polyneuritis from deficiency of vitamin B_1. Later authors have doubted whether the disease seen by Marek was genuine fowl-paralysis, identical with the ailment which since has been detected in many other countries. Therefore, it may be confirmed that the descriptions of the lesions seen in the peripheral nerves of four hens, leave no doubt as to the massive infiltration with lymphoidal cells which is the principal character of the ailment. No further observations were published for some years till de Blieck, at the First World Poultry Congress, referred to the disease and stated that in 95 per cent. of the fowls paralysed he had found the duodenal cestode *Davainea proglottina*. The same year, Kaupp (1921) mentioned that he had seen several outbreaks in the United States, but had not been able to identify any microbe connected with the disease or transmit the condition by inoculation to healthy chicks.

Further observations on the disease, as it occurred in Holland, were published by van der Walle and Winkler Junius (1924), and in the United States by May, Tittsler and Goodner (1925). The latter authors mention that they had been informed that the disease had existed in the United States far back as 1878.

L. P. Doyle (1926 to 1929), studying fowl-paralysis in the United States, came to the con-

clusion that it was a specific disease induced by some virus which attacks the nervous system. He was unable to reproduce the disease by inoculation, but showed by breeding experiments that it was transmitted through the egg and also possibly by contact. He doubted its connection with tapeworms or other parasites.

Pappenheimer, Dunn and Cone (1929) completed a thorough study of the pathology of the disease and proposed the name "neuro-lymphomatosis gallinarum" which, being singularly appropriate, has been adopted by pathologists to designate the condition. These authors thought that the agent responsible for the alterations of the nervous system is not exclusively neurotropic, but that in certain instances it may induce proliferation of the lymphoid cells in the viscera; in this way they explain the frequent occurrence of lymphoid tumours in their paralysis-affected fowls.

It is difficult to decide whether neuro-lymphomatosis has gradually spread from different centres, or whether the disease has been authochthonous, and its recognition due to an increased interest in poultry pathology. However this may be, Dobberstein and Haupt (1927) seem to have originally studied this disease in Germany and proposed the name "Polyneuritis interstitialis chronica." Then Seifried (1930) recorded his observations, also in relation to German fowls. The condition seems to differ somewhat from the form of fowl-paralysis described by others, because Seifried (1929) appears to have found no difficulty in transmitting the ailment by inoculation and even by ingestion of pathogenic material; he states that the "virus" can be preserved during six months in glycerol, with slight loss of activity. Moreover, this form of fowl-paralysis occurred mostly in winter, and the lesions illustrated differ somewhat in type from those shown by Pappenheimer and his co-workers (1929).

Thomas (1928) reported the occurrence of fowl-paralysis in South Africa. Emoto and Myamoto (1930) described neuro-lymphomatosis in Japan, where they consider it was introduced by imported breeding stock. Hall (1931) observed neuro-lymphomatosis in Nigerian fowls; Manley (1932) reports its occurrence in Cyprus.

This avian disease was first observed in the United Kingdom by Galloway (1929), who briefly alluded to having transmitted the condition in two fowls by intra-cranial inoculation; then by MacGaughey and Downey (1930), and Marginson and MacGaughey (1931), who clearly insisted on the occurrence of the disease in certain definite strains; Findlay and Dalling (1931), who demonstrated microscopical specimens of the nervous lesions of the disease; Warrack and Dalling (1932), whose work was chiefly connected with the experimental transmission of "fowl-paralysis." Bayon (1931), who compared the lesions seen in this country with those obtained from fowls in the United States, noted their identity and divided the ailment into an acute and chronic form, and attempted to fix the pathology of neuro-lymphomatosis in its main elements, so that it could be distinguished from allied forms of fowl-paralysis.

PREVALENCE AND DISTRIBUTION: AGE, SEASON, SEX, BREED

The prevalence of neuro-lymphomatosis is not restricted to certain localities; on the contrary, it is widely distributed, because I have received cases from Scotland, Wales, Northern Ireland and England. That certain breeders have suffered more than others is clear and it is undeniable that the spread of the disease has been furthered by the common practice of selling off stock which showed signs of going lame or paralysed.

Age is relatively strictly limited—not earlier than three to four months and usually not later than six to seven; there are, of course, exceptions, but this rule holds good in three out of four fowls diagnosed. The seasonal prevalence corresponds to a rapidly rising peak in May and June, continuing during July and August, and rapidly diminishing during September; by October or November very few genuine cases can be obtained. Both sexes may be affected, but from the pathology of neuro-lymphomatosis, one may suspect that it should occur more frequently in hens, as the result of the stress of beginning egg production.

No breed can be considered immune, though strictly speaking my records show that it has been noticed in these breeds: Rhode Island Reds, White Leghorns, Welsommers, White Wyandottes, Barnevelders and, in one instance, British game; Sussex crossed with Rhode Island Reds, Welsommer crossed with Rhode Island Reds. Pappenheimer (1929) mentions that the following breeds were represented in his observations: White Leghorns, Silkies, Silver-spangled Hamburghs, Plymouth Rocks, Buff and White Wyandottes and Rhode Island Reds. He adds that in this series the lesions were identical, irrespective of breed.

CLINICAL APPEARANCES

As the result of experience extending over three years and the prolonged observations made not only on many farms, but also on 200 birds reared in the Institute, it must be confirmed that the diagnosis of neuro-lymphomatosis is not feasible through the inspection of external appearances alone, or even in conjunction with the gross lesions which can be observed after death in the internal organs and peripheral nerves. This reliance on clinical symptoms and diagnostic "flair" has frequently resulted in mistaken labelling and consequently been followed by heavy losses of poultry owing to wrong

treatment and misapplied preventive measures. The sudden appearance of complete or even partial paralysis in several pullets of the same age, necessarily arouses suspicion as to the occurrence of neuro-lymphomatosis, but for the purpose of diagnosis a complete anatomical examination of numerous fowls is required. The attempt to decide on the basis of twisted necks or dropped wings in one or two birds is to be strongly deprecated, for both of these symptoms occur as the result of many different morbid conditions.

So much being admitted, it may be stated that the presence of neuro-lymphomatosis in a stock of fowls usually becomes noticeable through one or several pullets seeming listless and weak, either crouching in corners or refusing to run out in the morning when the house is opened. Others, when they walk about in the run, are seen to limp or stumble, or it may be observed that if they are dropped from a height, they are unable to use one or both wings. In a few days, a week at most, lameness and debility increase rapidly and the pullets fall to the ground and may be unable to move their legs or wings. Paralysis is flaccid in the beginning, that is, the limbs can be passively moved, but it soon takes on a spastic character, the muscles are wasted and the joints become fixed and stiff, the claws being retracted. In this condition the fowls are usually unwilling to take food, and die of inanition; forcible feeding with mash will prolong their life, but leaves the paralysis unaltered. An important point to observe is that in the first stages of the disease the condition of the pullets is relatively good and the vent is not soiled; no emaciation is present. Where early paralysis is accompanied by ruffled feathers, a loss of condition and watery or blood-stained droppings, the presumption is that either coccidiosis is incriminated or complicating neuro-lymphomatosis, if the typical lesions of the latter are present in the peripheral nerves.

Lastly, what is usually called " blindness " should be mentioned. In a certain proportion of instances this is really faulty vision through lack of accommodation, due to infiltration of the iris by lymphoidal cells, the outward visible result being that the yellow-red iris becomes mottled with grey. Complete blindness or amaurosis does occur, the optic nerve being infiltrated with extraneous cells. The condition known as " grey eye " or " pearly eye " is, however, fairly common in fowls quite apart from neuro-lymphomatosis and has been known under these names to practical poultry breeders for some time; its presence in fowls has been considered to be adverse to the value of the strain in which such pale eyes occurred. Lately several authors—one may mention Warrack and Dalling (1932)—have insisted on the presence of grey eye as one of the symptoms of fowl-paralysis. Accordingly, particular attention has been given to this condition in the course of field observations and necropsies and the following conclusions have been made:—

Grey eye may occur as the result of several pathological processes, for it has been observed in the following conditions:—

(*a*) as the result of generalised tuberculosis; typical lesions then occur in the iris or cornea;

(*b*) as a gradual depigmentation or increasing paleness; also (*c*) as a cloudy eye, without change in the iris, but due to opacity of lens and crystalline. These changes are possibly due to lack of vitamin A;

(*d*) as a peculiarity of congenital origin;

Irregularly-shaped Pupil in Fowl with Neuro - Lymphomatosis.

Reproduced by courtesy of " The Feathered World." Photograph: Turner and Sons, Cambridge.

(*e*) lastly, as the result of lymphoidal infiltration of the iris, therefore part of the general lymphoidal infiltration seen in neuro-lymphomatosis. This lesion is distinguished from the others because it begins as a mottling of the iris and ends in the iris contracting or becoming oval and distorted.

PATHOLOGY: GROSS ANATOMICAL LESIONS

It has been explained that the presence of certain gross anatomical lesions in fowls can induce the tentative diagnosis of fowl-paralysis, which can then be confirmed or negatived by the microscope.

The blood can be examined and should then reveal an increase of cells of the lymphoidal series, *i.e.*, to 16,000-20,000, instead of the usual number of 8,000-12,000.

Such lesions consist in pink, irregularly thickened nerves in the limbs, whether legs or wings, which have been paralysed; this is a sign which has to be carefully searched for—not only by exposing the nerves involved till the spinal ganglia are reached, but, in addition, by comparing them with those of the corresponding side. The spleen is usually somewhat over-sized, round, dark, firm; the liver, dark, enlarged. The ovary is, as a rule, undeveloped, compact, either white or purple, and shows minimal pinhead-sized yolk formation. The oviduct is also correspondingly undeveloped, appearing as a straight milky-white line about 2 m.m. broad. It should be remembered that these features may possess no particular pathological significance in pullets four to five months old, whilst in those six to seven months old they solely indicate retardation of normal growth. In some instances the ovary is much enlarged, purple, chestnut-sized, having been substituted by a solid lymphoidal proliferation. In such instances the oviduct has developed, even if not fully; it may be seen as a pink, folded, flattened ribbon about 4 m.m. broad. Liver and kidneys do not differ in appearance from those usually seen in routine necropsies. Summarising, therefore, particular attention is to be paid to the peripheral nerves, their ganglions, and then to ovary and oviduct, and spleen.

The gross morbid lesions of neuro-lymphomatosis are thus found to consist in:—

(1) Primary lymphoidal accumulations in the peripheral and central nervous systems, at times noticeable to the naked eye.
(2) The presence of "grey eye" or mottled iris.
(3) Lack of development of the ovary and oviduct or the occurrence of lymphoidal ovarian and other tumours.
(4) Alterations of the blood, particularly in relation to white cells, and corresponding microscopical deposits of lymphoidal cells in the inner organs.

MICROSCOPICAL ANATOMY

A complete study of the pathology of neuro-lymphomatosis is to be found in Pappenheimer *et al* (1929). These authors sum up their findings as follows (p. 84):—

"8. The principal pathological changes are found in the nervous system. In the peripheral nerves, the essential feature is an intense infiltration of lymphoid, plasma cells and large mononuclears. This is accompanied by myelin degeneration in the more advanced lesions, but the cellular infiltrations appear to precede the degenerative changes. In brain, cord and meninges, there are similar infiltrations, predominantly perivascular.

"Infiltrations of the iris with lymphoid and plasma cells are found in the cases showing gross discolouration of the iris.

"Visceral lymphomata, originating usually in the ovary, are associated in a certain percentage of the cases. Evidence is presented in favour of the view that this association is not accidental and that the lymphomata are a manifestation of the disease.

"9. Infiltrations of the spinal cord and brain, rarely in the peripheral nerves, are present in birds showing no clinical symptoms. These are interpreted as mild cases of the same disease.

"10. No micro-organisms of etiological significance have been demonstrated in the tissues or by cultural methods."

The investigations of Pappenheimer and his co-workers are certainly the most accurate in relation to the anatomy of the neuro-lymphomatosis, and little can be added or altered to what is quoted. Nevertheless, the development of the lesions seen in fowls in this country is described, because the recognition of the ailment, in practice, has not always been guided by a knowledge of the microscopical lesions—the presence of which, to the total exclusion of other signs, can alone justify the diagnosis of neuro-lymphomatosis.

Development of Neural Lesions seen in Fowls in Great Britain.

It has been remarked by Pappenheimer *et al* (1929), p. 76: "One of the puzzling facts which have made the experimental study of the disease very confusing and difficult, is the frequent occurrence of lymphoid infiltrations in the nervous tissue of chickens which are not paralysed and which betray no clinical evidence of disease. While it is true that in most of these apparently healthy birds the lesions are trifling and, indeed, may fall within the range of normal variation, in others they are so intense and widespread that they cannot but be regarded as pathological." These authors then specify that such lesions were seen in the brain

and cord and only once in the peripheral nerves, and that in a chicken from a locality in which paralysis did occur.

In the material examined in connection with the present investigations, therefore, particular attention was given to any lesions in the nervous tissues of fowls which did not present any symptoms of paralysis. It can be stated that in no bird, either in the brain or peripheral nerves, were lesions detected which in texture and intensity could be correlated with those seen in neuro-lymphomatosis. The problem is rather different from that mentioned by Pappenheimer, as far as it affects fowls in this country; here the difficulty mainly is to trace typical lesions in birds which, during life, have been obviously paralysed. That lesions can be detected in fowls with paralysis induced by tapeworm infestation, and that scattered infiltration occurs in tumours, has been illustrated in the previous paper (1932) in the *Veterinary Record*.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis is governed by the microscopical findings in the peripheral nerves; this is generally admitted. What the microscope should reveal in neuro-lymphomatosis is known —massive accumulations of lymphoidal cells within the sheath of the nerves of the limbs affected by paralysis, correspondingly swollen, enlarged ganglia in the vicinity of the spinal cord and peri-vascular "cuffs" in the central nervous system. Without the presence of these lesions one is not justified in deciding the diagnosis of the disease; particularly is it incorrect to be guided by the presence of tumour-like conditions of the ovary or other organs, without typical neural lesions.

The two conditions which are most frequently confused with neuro-lymphomatosis are chronic coccidiosis and infestation by the cestode *Davainea proglottina*. Where, as it sometimes happens, the occurrence of neuro-lymphomatosis is accompanied by these parasites, the distinction of the various conditions necessarily involves the slaughter of many ailing birds and careful protocols of the lesions noticeable. It will then be seen that whilst the coccidia or tapeworms may occur in nearly all birds, irrespective of their origin, neuro-lymphomatosis is confined to birds of some particular breed or strain, that is, birds from some definite source. Further, though the appearance of the birds may be some guide, it should only be relied upon for the purpose of picking out ailing birds from those which are apparently healthy. Then the observation can be made that fowls with neuro-lymphomatosis, though completely paralysed, have, in the first days at least, a better appearance than those suffering from coccidiosis or Davainea. The reason for this difference is that paresis occurring in parasitised birds is usually the outcome of a long-standing condition, which has already weakened the bird. On the other hand, neuro-lymphomatosis more often attacks a pullet which is actively growing. This is a very essential distinction, for in Warrack and Dalling (1931), under Figs. xi and xii, one finds illustrated as subjects of fowl-paralysis birds which present all the exterior appearances of chronic coccidiosis.

When the gross lesions of these ailments are being examined, the naked-eye appearance of the nerves is by no means sufficient to decide the diagnosis, because simple neural hypertrophy may occur without lymphoidal infiltration and, on the other hand, lymphoidal cells may accumulate without appreciably enlarging the nerve. The size of the spleen may afford a slight indication, for in uncomplicated neuro-lymphomatosis it is usually dark and enlarged, whilst in chronic coccidiosis it is more often pale and small.

From all this one may safely deduce that there is only one method known at present for the purpose of accurate differential diagnosis, and that is by means of a careful microscopical analysis of the type and disposition of cells which are present in greatly increased numbers and density in parts of the peripheral nervous system.

"Encephalo-Myelitis" in Chicks

It may here be mentioned that E. E. Jones (1932) has described a disease of chickens which this author names "encephalo-myelitis." The lesions found in the nervous system differ somewhat in intensity and degree from those seen in neuro-lymphomatosis, and might well be considered identical with those described by Bayon (1931) as acute neuro-lymphomatosis.

The outward symptoms were pronounced and rapid tremors of the head and neck, which in some chickens were fine and in others coarse; in some intermittent, in others continuous in the waking hours. Ataxia was present in some birds when brought to the laboratory, whilst in others it developed whilst under observation. A total of 102 birds was studied; of these some recovered, whilst others grew progressively worse and even within a week of the onset of the ataxia were moribund. Transmission experiments were successful in six chicks and were accomplished by intra-cranial inoculation of a suspension of brain or spinal cord of an affected bird; the disease became apparent between four to six weeks after inoculation. All the birds developing disease after inoculation exhibited numerous lesions both in brain and cord, and these consisted in focal collections of neuroglia around capillaries, in which mitotic figures were found. The lesions in the viscera consisted of areas of infiltration with lymphoid cells; the pancreas and the heart were the organs more severely affected by these infiltrations, but other organs were also involved in varying degrees.

The differences between this condition and neuro-lymphomatosis are apparently great, but on closer analysis it is revealed that the tremors and the ataxia obviously occur in the course of outbreaks of fowl-paralysis, and the lesions of encephalo-myelitis resemble those of the condition illustrated by Bayon (1931) and described as acute fowl-paralysis. Though the age incidence differed, the symptoms of the latter disease corresponded to those observed by Seifried (1930), whose transmission by inoculation was apparently relatively easy.

A conclusive opinion cannot be expressed at the present moment, since experimental evidence is still incomplete, but the further comparison is well worth considering.

ETIOLOGY

1.—Intestinal Parasites

A. The Duodenal Tape-worm Davainea proglottina.

Several authors, such as De Blieck (1921), Kotlan (1925), T. van Heelsbergen (1927), Nieman (1929), Dearstyne and Greaves (1930), have suggested that the minute duodenal tapeworm plays an important part in the causation of fowl paralysis. It may be also mentioned that many other observers deny any such correlation, as, for example, Thomas (1928), L. T. Doyle (1929), Leonard Taylor (1931).

Since the observation of the massive occurrence of *Davainea proglottina* in fowls with erythromyelosis, particular attention has been paid to the occurrence of this tapeworm in all necropsies performed in the Molteno Institute. The idea has thus been obtained that where heavy infestations are extant in the duodenum, their presence must necessarily cause some sort of pathogenic reaction in the general condition of the bird. Among these, lameness and temporary paralysis in fowls can be reasonably attributed to the infestation with this cestode, but though in such instances the nerves may appear thickened or even reddened with dilated surface vessels, the intense infiltration with cells of lymphoidal origin which is typical of " fowl-paralysis " is always lacking.

The significance of small infestations is more difficult to assess; they are obviously very frequent in forms of weakness and temporary lameness, which are commonly confused with fowl-paralysis. Accordingly it may be possible that in a bird predisposed to develop neuro-lymphomatosis the condition may be aggravated by the tapeworm infestation; this, indeed, seems to be the case in several observations.

B. The Cæcal Round Worm Heterakis papillosa.

The etiological significance in fowl-paralysis of the cæcal roundworm, *Heterakis papillosa*, has been suggested by Downham (1931), who, in a paper dealing with some of the first outbreaks of the disease in Great Britain, pointed out that, in the birds with the form of paralysis he was describing, cæcal worms were constantly found.

Even if dealing with an intestinal parasite as common as *Heterakis papillosa*, and one which, in the majority of instances, appears to cause little harm, one cannot deny that, under certain ascertainable circumstances, the worms may be present either in such numbers or in the presence of weakened tissues so as to be harmful. It is true that these worms are detectable in 42 per cent. of the fowls which are sent in for diagnosis of fowl-paralysis and similar ailments, but the proportion is no higher in those in which neuro-lymphomatosis can be ascertained.

One may therefore leave the question open whether or not these worms play an important part in the causation of true fowl-paralysis or paralysis symptoms in general.

C. Duodenal and Cæcal Coccidiosis.

In relation to the pathogenic significance of coccidia, even such a reliable observer as J. R. Beach (1930), after discussing whether parasitism alone can cause paralysis, concludes: " Nevertheless, the almost constant finding of coccidial enteritis in paralysed birds in some sections makes it appear that the two conditions are in some way inter-related, instead of being simply two diseases happening to appear coincidentally."

Lee and Elder (1930) state: " . . . . we have been able to find coccidia in practically all cases of fowl-paralysis when thorough examinations have been made. We therefore believe that chronic coccidiosis is one of the most important causes." Then Stafseth (1931) considered that leg weakness and paralysis occurred more frequently with duodenal than with cæcal coccidiosis. Dalling and Warrack (1932), p. 75, remark: " During the past rearing season the chief factor responsible for the production of evidence of fowl-paralysis in many outbreaks seemed to be chronic duodenal coccidiosis." Against these various statements numerous negative opinions can be adduced, principal among which one may quote Pappenheimer *et al* (1929), who definitely state that the incidence of coccidiosis was not more frequent among paralysed birds than those not so affected, for among 60 spontaneous cases of paralysis, coccidia were found in ten, whilst in 33 non-paralysed birds from various sources coccidia occurred in four.

These authors bring further evidence from their experimental material and then conclude: " From the foregoing data, it is very evident that there is no correlation whatever between infection with *Eimeria avium* and the incidence of fowl paralysis." The question may also therefore reasonably be considered from the standpoint of personal observation, for which, in addition to field observations, occasion was afforded in the first instance by an unwelcome accidental laboratory infection with coccidiosis,

the features of which have been fully described in the *Veterinary Record* of April 23rd, 1932.

The ultimate result of this infection and others observed can be summarised in the statement that the type of paralysis occurring as the result of coccidiosis should be recognisable by the careful observer, since it differs in development, general appearance and ultimate lesions. Where, for any reason, doubt arises, the differential diagnosis is feasible by microscopical analysis of the features of the lesions detectable in the peripheral nerves and internal organs.

The gross differences have already been illustrated by photographs and can be stated, in few words, as follows: in neuro-lymphomatosis paralysis of one or more limbs develops rapidly and permanently, with relative good condition of feathers and flesh, whereas in coccidiosis the birds are emaciated, anæmic, badly feathered, and the vent is soiled, and the birds gradually become weaker and lameness is fitful, being more evident on some days than on others. The internal organs show little difference in neuro-lymphomatosis; in coccidiosis, on the other hand, they are pale and shrunken. The spleen is particularly apt to reveal such differences; ovary and oviduct may be backward in development in both conditions; moreover, the bone marrow of the femur is usually redder in coccidiosis than in neuro-lymphomatosis. The gross appearance of affected nerves may also give some indications, for in neuro-lymphomatosis they may be pink, irregularly thickened; in coccidiosis no thickening occurs, but the capillaries of the surface appear red and dilated, and congested pink patches appear.

The conclusive difference is microscopical, since in coccidiosis the lesions consist in scattered peri-vascular, focal lymphoid-cell infiltrations congregating around dilated capillaries; whilst in neuro-lymphomatosis we are dealing with a massive infiltration, which covers the whole field of vision and in which mitosis is frequent.

It is not only a question of degree, but, above all, of the nature of the morbid alteration; one, neuro-lymphomatosis, is a proliferative process; the other a reaction of an irritative or inflammatory nature, and no pathologist should confuse these essentially different processes. It may perhaps be added that whilst previous claims as to the identity or difference of fowl-paralysis and paralysis through coccidiosis were founded on uncertain criteria, such as occurrence or incidence, here a definite test can be presented for discussion and eventual recognition.

2.—Filterable Virus

When examined from the viewpoint of experimental pathology, the impression is easily obtained that the lesions occurring in certain instances of fowl-paralysis resemble those seen in neuro-tropic "virus diseases." These lesions are, for example, the peri-vascular "cuffing" in the nervous system, and the proliferative properties of the cells of the lymphoidal type which invade the peripheral nerves; to these may be added the severity of the symptoms, relatively to the slight alterations detectable. Against such suggestions, it may well be brought forward, particularly by those who have experience of the more active viruses, such as those of fowl-pox and fowl-plague, that the acknowledged difficulty in communicating fowl-paralysis rules a virus causation clean out of court. Again, not unreasonably, it may be remarked, in view of the definite points of contact between neuro-lymphomatosis and lymphoma tumours, that experience with fowl-viruses of the Rous-fowl-sarcoma type is relevant to the question of etiology and experimental transmission of the former conditions. It may be considered, therefore, that experimental inoculation is attended by a small percentage of positive results in the first transmissions, and that strain virulence is only gradually acquired, if at all.

As a relevant example, it may be mentioned that Jarmai and his co-workers (1932) have succeeded in transmitting through many generations, by means of Berkefeld filtrates, a disease of fowls which they consider a "leucosis." In my opinion, judging from the appearance of the specimens which Professor Jarmai has kindly sent me, this hæmopathy of fowls belongs to the group of lymphocythæmias, and, as such, would approach neuro-lymphomatosis in a pathological classification. Apart from such considerations, it is noteworthy that Jarmai *et al* (1932), who obtained inoculation material from 17 outbreaks of this disease, have succeeded in transmitting it in two separate instances only.

Nevertheless, all these suggestive observations do not amount to positive proof, experimental or otherwise; therefore it is the task of future research to investigate and decide whether the *causa causans* of neuro-lymphomatosis is a filterable virus or not.

3.—Nutrition

All authors seem to agree that the disease is not nutritional in inception. It has been seen that Marek (1907) was positive that the disease differed from the polyneuritis seen in rice-fed pigeons and hens. The standpoint of Bayon (1931-2) may be worthy of explanation, as it has been frequently misunderstood. It amounts to this, that the lack of vitamins, particularly A and C, at an early age influences the development of the disease in so far that this deficiency determines the localisation of the lymphoidal cells in the peripheral nerves, which are damaged by the absence of vitamins which are known to affect the nervous system.

To Blount (1932) we owe the suggestion that fowl-paralysis is due to an excess of vitamin B in the food; this author then considers the sug-

gestion in the light of the work in relation to vitamin D poisoning, which is a different matter altogether.

4.—Other Possible Agencies.

In view of the active interest in all pertaining to the subject of fowl-paralysis, it is not astonishing to find numerous other suggestions relative to its etiology; but since many of them are but random shots, unsupported by collated observations, it is difficult to do more than mention them.

On separate occasions Blount (1932) pointed out the influence of the lack of grit in the gizzard and the use of slatted-floor houses in the causation of fowl-paralysis. The observations on which such suggestions are based are not adduced, but a questionnaire sent out by a poultry society, and then sifted by Blount, did not seem to afford strong support for either view.

Inbreeding, the use of battery brooders, the admixture of soya bean to the food, the presence of "acidosis," etc., etc., have all been at some time or other adduced as "causes" of fowl-paralysis. It is not unreasonable to require that such observations should be supported, not only by accurate diagnosis of the disease, but also by the comparative observation of several outbreaks. It is admitted that any harmful condition, capable of affecting the vitality of fowls, can increase the mortality connected with most forms of "fowl-paralysis."

METHOD OF SPREAD IN NATURE

Though Pappenheimer (1929), who made a very careful study of the disease in the United States, is of the opinion that inheritance plays a small part in the spread of the disease, it can be asserted that observations made in the United Kingdom confirm the opinion of Marginson and MacGaughey (1931) to the effect that neuro-lymphomatosis is frequently parentally transmitted through the egg. Obviously it must also arise if not *de novo*, at least where no direct parental taint can be traced; still, the majority of outbreaks could be found to be restricted to some particular stock or strain originating usually from some definite source; though other strains on the same farm were treated in the same way and fed with the same food yet they did not develop neuro-lymphomatosis. An instance has been observed where purchased cockerels, some of which developed symptoms of paralysis, apparently introduced the disease into the resulting progeny.

Marginson's and MacGaughey's evidence seems conclusive, and can be found in the *Veterinary Record*, 1931, p. 573.

ARTIFICIAL TRANSMISSION

The possibility of the experimental transmission of neuro-lymphomatosis has been present to the minds of all those who have been scientifically interested in the disease. A survey of the literature will, however, reveal that until Pappenheimer and his co-workers (1929) succeeded in reproducing neuro-lymphomatosis by the inoculation with unfiltered diseased tissue, no positive results had been achieved and that since then confirmation has been restricted to few authors.

The inoculation experiments of Seifried (1930) differ from other observations, for this author was able to transmit the disease even by ingestion of the "virus"; this is contrary to usual experience with viruses, so that the possibility presents itself that this may have been a different type of paralysis, as indeed the microscopical sections indicate.

Warrack and Dalling (1932) have reproduced the disease by inoculation, but from their protocols it is not clear whether they succeeded in producing definite neural lesions or merely relied on the appearance of paretic symptoms in their inoculated chicks. In any case, their proportion of successful inoculations was approximately 25 per cent., and corresponds to the results of Pappenheimer *et al* (1929).

Since several authors have reported numerous negative inoculations, one may conclude that the experimental transmission is not easy.

Bayon (1932) has published micro-photographs in the *Veterinary Record* showing the transmission of a lymphomatous tumour to chicks, but it will be noted that both the original fowl and the inoculated chicks did not show lesions in the nerves.

Nevertheless, in relation to these tranmission experiments it should be understood that the fowl from which the inoculation material was obtained was reared on a farm on which neuro-lymphomatosis occurred, and, moreover, the disease was accurately diagnosed in birds of the same stock or progeny; still, since the fowl did not show typical lesions in the nerves, nor did the inoculated chicks develop such, it is difficult to consider the results in connection with the transmission of neuro-lymphomatosis.

EXPERIMENTAL INOCULATION AND ETIOLOGY

My interpretation of these experiments can be stated in a few words. It is that proliferating lymphoidal cells can be transferred by inoculation so that they preserve their property unaltered in a new host; but that to bring about their localisation in the peripheral nerves a further predisposing condition is required, capable of rendering the nervous system receptive. Among these predisposing conditions one may reckon the lack of essential vitamins at an early age, whose absence, it is known, influences growth and the health of the nervous system.

IMMUNITY

In discussing this question, one cannot avoid postulating that the term immunity be defined, since it now embraces several different reactive processes, both cellular and humoral.

If by immunity one means the resistance to inoculation with the pathogenic material of neuro-lymphomatosis, then this immunity obviously exists and is widespread.

If, on the other hand, by immunity is meant the existence of anti-bodies in the blood serum, then this can scarcely be ascertained or measured, in view of the obscurity still enfolding the *causa causans* of neuro-lymphomatosis. It is, however, well possible that the immunity to the disease is of the nature of cellular resistance, which is recognised in some diseases caused by proliferative viruses—such as vaccinia, for example. Such inherent resistances have been more accurately studied in connection with plants and phytopathological viruses.

PREVENTION

The preventive measures recommended by MacGaughey (1930) are the following:—

> Prevention.—Although no methods of prophylaxis have yet been devised, the following recommendations might be useful in preventing serious losses.
> (1) Diagnosis should be made as early as possible.
> (2) All affected birds should be destroyed as soon as they are detected.
> (3) Infected premises should be thoroughly disinfected.
> (4) An infected flock should not be used for breeding.
> (5) Poultry farmers should ensure that eggs bought for hatching, chicks, pullets and cockerels have come from flocks free from all suspicion of the disease.
> (6) As the disease usually appears first in young pullets from four to eight months old, it is advisable to isolate the older breeding pullets on uncontaminated ground and to take every precaution to prevent contact, direct or indirect, between the young birds and the older birds.

The question of prevention is obviously closely linked with what one may know about the causation of neuro-lymphomatosis and its features; it will be seen that Bayon (1932) holds that the disease is aggravated by a lack of green food at an early age, and accordingly he sums up the preventive measures he recommends as follows:—

> Four simple precautionary measures are quite sufficient to control the further spread of this disease, which is particularly dangerous when not understood or when neglected. These four cardinal suggestions are:—
> (1) Careful scrutiny of breeding stock.
> (2) Suitable feeding of young chicks.
> (3) Accurate diagnosis of early cases.
> (4) Judicious culling of all undersized birds.

The hygienic measures to be taken in relation to different poultry parasites have been described in the *Veterinary Record*, December, 1930, to which reference can be made.

Particularly in connection with prevention, past experience shows that neuro-lymphomatosis will naturally cease in the course of three or four seasons, for both the ovaries and testes are frequently infiltrated with lymphoidal cells, and this results in sterility or diminished fertility. This gradual method of ridding stock of the disease is apt to be very expensive and, therefore, once the diagnosis of neuro-lymphomatosis has been made, a rigorous selection of all backward pullets must be made, which must not stop till all inferior birds are weeded out, even if 75 per cent. have to be killed and sent to market. Such a recommendation may appear to contradict the statement that under suitable conditions mortality through neuro-lymphomatosis does not surpass 10-12 per cent. These figures refer to definitely diagnosable cases; it is, however, the rule that in large flocks where neuro-lymphomatosis occurs among closely related birds, low egg production, unthrifty hens, etc., are present in considerably larger percentages and are capable of transmitting the taint to their progeny, even if this may be small in numbers.

The anti-parasitic measures recommended are, above all, intended to influence the mortality through complicating factors like coccidia; they are not directed against the presumed "virus" of neuro-lymphomatosis.

TREATMENT

Judging from the great majority of pronouncements on the subject, it appears that there exists no treatment which can be recommended in fowl-paralysis. In contradiction to this viewpoint is the statement of Bayon (1931, 1932), who asserts that he has repeatedly cured paralysed fowls by means of a course of forcible feeding with fresh lettuce leaves consistently carried out during ten days to a fortnight; fowls which were sent in completely paralysed, unable to move, picked up, began taking food spontaneously and eventually walked about and came into lay.

The first batch of experiments numbers 38, and included any and every form of paralysis; this group showed that only in genuine neuro-lymphomatosis could any improvement be noted, and then only in less than half. Where the disease was the result of coccidiosis, tapeworms

or internal tumours, no improvement resulted. Photographs were taken of the birds before and after treatment, whilst other photographs relate to birds which, to all exterior appearances, recovered completely.

Since diagnostic errors are possible, if not guided by microscopical examination, the nerves of cured fowls were examined after death. [An illustration of a typical example was shown, which clearly demonstrated the scar tissue resulting from the healing of a definite lesion of the sciatic nerve. This microphotograph was reproduced in the *Veterinary Record*, Vol. xii, No. 17, page 461.]

These experiments were continued during the summer of 1932 on 22 selected fowls with definite symptoms of neuro-lymphomatosis. The ultimate result has been the same; eight fowls can be considered cured, in so far that they lived, picked up and began laying, even if the eggs are small and rare; the remainder did not improve sufficiently and were killed. It should be explained that twelve fowls of this test were kept on a farm (Brandon) for the purpose of seeing whether the treatment succeeded in other hands.

During the summer of 1933 forcible feeding with lettuce on paralysed fowls has been continued on small groups of three to five fowls, with the same results; where the paralysis was not complicated by coccidia, or a tumour was not present, about half the numbers of the fowls so treated recovered, that is, began taking food spontaneously and walked. Birds under treatment can be seen any time at the Molteno Institute, Cambridge.

Such are the results obtained by the treatment with lettuce; it may be added that in the winter, on small numbers (five hens), similar improvements were obtained with watercress. No experiments have been carried out to identify the substance or substances responsible for the beneficial effects observed, though it is thought that these may be akin to vitamins A and C. For the purpose of attempting to exclude the effect of other vitamins known to be present in lettuce leaves, vitamin B was fed in the form of baker's yeast, and vitamins A and D as cod-liver oil; also raw meat and milk; no results comparable with those accruing from lettuce were obtained. These experiments were performed on fowls which were beginning to improve, and then, by withholding lettuce or green feed for a week, again relapsed; that is, again became paralysed.

This is as far as the investigations in relation to treatment have progressed, and even at the present time there is considerable difficulty in deciding what relevance, if any, these observations have to the problem of the etiology of neuro-lymphomatosis. From the result of field observations it must be admitted that the majority of outbreaks of neuro-lymphomatosis occurred on farms where the green feed appeared sufficient and even abundant—at all events, when the symptoms of neuro-lymphomatosis were noticed. The only suggestion that can be made is that either the green feed was lacking during the early period or its etiological importance was not definite. This, however, was repeatedly noticed—that on farms where proper attention was paid to sufficient green feed, the mortality and even the incidence of neuro-lymphomatosis remained within single figures per cent.

(*To be continued with Lecture No.* 2.)

Clinical Communication

SOME NOTES ON THE USE OF "YATREN VACCINE E" IN A CASE OF INTERDIGITAL ABSCESSES

F. J. KINGHORN, M.R.C.V.S.
Glasgow

Subject.—An Airedale dog, aged eight years.

History.—The owner of the dog had been in the habit of giving him tit-bits. These tit-bits consisted of pieces of cake, chocolate and scraps from the table. About five years ago occasional cysts appeared from time to time between the toes on the dorsal surface of the fore paws, but caused little inconvenience. Later the condition became aggravated, the cysts becoming more numerous and the intervals between their appearance and disappearance shorter; lameness was marked, and there was a general falling off in condition. Eventually the condition became chronic, pus and blood exuding from the paws, which were badly swollen and inflamed. On several occasions the animal had been treated for the trouble, but with little or no effect. When I saw the dog first his condition was so serious that I almost advised destruction. He could not walk, was eating practically nothing, had a foul odour from his breath, and a copious purulent discharge from both eyes. He showed no interest in anything, would not go out, and spent most of his day lying in a cool spot.

Treatment.—The first step in the treatment consisted in placing the animal on strict diet. This consisted of raw meat, green vegetables and dog biscuit; no tit-bits of any kind were allowed. A vaccine prepared by Messrs. Bayer, Ltd., and known as "Yatren Vaccine E" was given in subcutaneous injections of 1 c.c. per week, the site of injection being just behind the shoulder blade. The animal was also put on to a saline laxative containing mag. sulph. and mag. carb. The nails were clipped and the feet

bathed each night in a 1 per cent. solution of Rivanol. The eyes were washed in boracic acid solution.

At first the results were somewhat disappointing, the condition becoming, if anything, worse. After the third injection, however, some slight improvement was noticed—the appetite improved and the discharge from the eyes ceased. The dog was able to put weight on one paw and seemed livelier in himself. This improvement was maintained and, after the sixth injection, he was able to walk fairly soundly and evinced a desire to go out. His appetite was good, the swelling of the paws had decreased considerably and the whole general condition showed marked improvement. He received his seventh injection a few days ago, and since then has been running about, and seems to be practically free of any inflammation and pain in the feet.

Note.—The owner has been advised to continue with the saline laxative. In all probability it will be a little time before the feet harden up. Although they have decreased considerably in size it is unlikely that they will ever become absolutely normal, owing to the fact that the chronic nature of the trouble has resulted in a certain amount of fibrosis. The results of this course of treatment have been distinctly encouraging. No worse case could have been found on which to test the vaccine, and, in my opinion, many cases of this distressing canine affliction could be cleared up by this method. Naturally, the results obtained in this one case do not justify any claims being made for this vaccine as a specific, and it would be of interest to hear other veterinary surgeons' experiences with this preparation.

There is little doubt that the condition is aggravated, if not caused, by the habit which many dog owners have of feeding tit-bits to their pets under the mistaken impression that they are doing them a kindness.

WORLD'S POULTRY CONGRESS, 1933.

Entries have now been received for the live stock to be included in the British exhibit at the above Congress, and as the Congress Exhibition affords a splendid opportunity to demonstrate the value of British poultry, extreme care is being taken that only stock of the highest quality shall be accepted. The technical and secretarial services required in connection with staging the national exhibit are being provided free of cost, and no Government grant is available for this purpose. To meet necessary expenses the British Committee is therefore making an appeal for £1,000, all of which amount will be used for securing adequate British representation at the Exhibition. Donations towards this object will be gratefully received by Mr. W. E. Walters, British Secretary to the Congress, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

Reviews

[Hoare's Veterinary Materia Medica and Therapeutics. Fifth Edition. Edited and Revised by J. Russell Greig. Baillière, Tindall and Cox, London. 1933. Price 21s.]

The fifth edition of this well-known book is now to hand. In general plan it conforms to that adopted in the previous editions, and comprises three parts. The first deals with diagnosis, the care and management of sick animals, etc.; the second with materia medica; and the third, headed Therapeutics, discusses shortly the etiology, symptoms and treatment of the common diseases associated with the various systems of the body.

Its scope is much wider than is customary in text-books on materia medica and therapeutics. It comprises 459 pages of text, with three appendices. The publishers have carried out the work with their usual care.

The section dealing with materia medica has been largely re-written, and the recent introduction of a new British Pharmacopœia has occasioned numerous alterations in nomenclature and composition of preparations. Many of the preparations, which, although no longer, official, have proved useful in veterinary practice, have been retained.

The use of the Imperial system of weights and measures has been retained, doses being indicated by symbols and Roman numerals. The recommendation of the pharmacopœia committee that in future the use of symbols shall be discontinued and that figures shall be in Arabic, has not been adopted.

The author has been mindful of the claims of pharmacology as a link between physiology and therapeutics in the teaching curriculum, and this subject has been concisely but adequately dealt with.

The sections dealing with vaccine and serum therapy, and biological test agents, have been revised and extended; whilst under "diagnosis" a very helpful series of urine tests has been included. Appendix III comprises a digest of the Dangerous Drugs Act as it affects practitioners.

That the author has taken great care in the preparation of the work becomes obvious after perusal of the pages.

Two points strike the reviewer as warranting criticism. The first—that the subject of anthelmintic medication might have received more detailed consideration. It is surprising that when dealing with carbon-tetrachloride no mention is made of the particular susceptibility of cattle to this drug. The other is that some of the prescriptions are too cumbersome, one—a worm remedy for a dog—comprising as many as eight ingredients. The modern trend in pre-

scribing is towards the use of single agents of a certain action in effective doses. This is a minor point.

The book is something more than a text-book of materia medica; it is, in fact, a short system of medicine, and, as such, will be found invaluable to practitioners as a book of reference, and to students as an adjunct to their course of lectures.

* * * * *

[**Diseases of Poultry; their Prevention and Treatment (A Practical Guide for Poultry Keepers).** By H. P. Bayon, M.D. pp. 154. 36 illustrations and photographs. Published by *The Feathered World*, Talbot House, Arundel Street, London, W.C.2. 1933. 3s. 6d.]

It is a pleasure to see published in this country a book on poultry diseases, written by a qualified investigator such as Dr. H. P. Bayon. This necessarily indicates that the facts incorporated in it will be authoritative, and that much of its originality will be associated with the author's well-known experiments in connection with "fowl-paralysis," vitamins, and diseases of the blood.

The book commences with a foreword by Mr. E. T. Halnan, of the School of Agriculture, Cambridge, who confidently recommends it to practical poultry keepers, but because of the many unusual and scientific terms incorporated in the text it is a pity that a glossary was not appended. A list of references and an index also would have been useful.

Nearly all the common and important diseases of poultry are discussed from their hygienic and simple pathological aspects, whilst, where possible, treatments or preventive measures are discussed.

The reading is concise and the print clear, but it is unfortunate that such a well-published book should have no cover title.

Intelligent poultry keepers and students of poultry husbandry and veterinary science will find much food for thought in its pages.

MUSK RAT NUISANCE ABATEMENT

In a report to the Salop Agricultural Committee, the County Agricultural Organiser said he believed that, as regards the Shropshire area, they were definitely overcoming the menace of the musk rat. "But," the report added, "it will take some time and our efforts must not be relaxed, and everybody should report at once any indications of the presence of musk rats."

During the twelve weeks since the last report 291 musk rats had been caught, 173 in the first three weeks.

* * * * *

NATIONAL SHEEP-BREEDERS' ASSOCIATION

Flockmasters from overseas and the homeland gathered at Derby, on July 3rd, for the thirty-second annual Conference of the National Sheep-Breeders' Association. The agenda included a paper by Major T. Dalling, M.R.C.V.S., on "A Consideration of Some Sheep Diseases; Their Prevention and Treatment."

Abstracts

[**The Hæmolytic Power of Streptococci Isolated from Mastitis of the Cow.** Lesbouyries and Adam. (1933). *Bull. de l'Acad. Vét. de France*, vi, 2, 78-83. (16 refs.).]

The writers conclude from their experiments that the production of hæmolysin by streptococci from the udder is not a constant character. This they showed by comparison of the degree of hæmolysis of cultures soon after isolation and after six to eight weekly sub-inoculations on serum agar—in most of the strains examined a considerable reduction in the hæmolytic power was observed.

J. S.

* * * * *

[**Technique of Anæsthesia of the Lower Limb in Bovines.** (Trans. title.) Pincemen. (1933). *Recueil de Méd. Vét. de l'Ecole d'Alfort.* cix, No. 6, 341-345.]

Author explains a method for complete local anæsthesia of the foot of bovines.

One per cent. cocaine with adrenalin was used.

All injections are made about two inches below the level of the metacarpo-phalangeal joints.

First injection of 10 c.cs. is made on the dorsal aspect of limb, above the interdigital space (affects both median dorsal digital nerves).

Second injection (10 c.cs.) is made in a similar position on the volar aspect of limb (affects both median volar digital nerves).

Third sites (two injections of 5 c.cs.) follow the course of the lateral dorsal digital nerves (on each side of limb).

Fourth sites (two injections of 5 c.cs.) follow the course of the lateral volar digital nerves (on each side of limb).

Ten minutes usually suffice for complete anæsthesia, and this lasts from three-quarters to one hour.

Diagrams for this and other methods of anæsthesia of the foot of bovines are given, and comparisons made.

C. V. W.

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[**On an Affection simulating Grass Disease.** Ries. *Recueil.* Jany., 1933.]

M. Ries, of the Veterinary School at Cureghem, who is the originator of the treatment of grass disease by temporary œsophagotomy, refuses to class under this name the malady here referred to, which, in his view—and he has known the affection for years—originates in disturbances of the digestive and nervous systems.

He explains (1) the worm-like movements of the œsophagus as resulting from occlusion of

the cardiac orifice of the stomach; (2) the patches of sweat on the sides of the neck as due to neuropathic effects, the point of origin of which is the stomach; (3) the muscular tremblings as attributable to non-septic local inflammatory processes; and (4) the decubitus, which gives temporary relief, to gastralgia.

The surgical treatment consists in the practice of œsophagotomy and the use of a rubber tube 1·80 metres long and 1 cm. in diameter, fixed by suture to the wound and the free extremity, closed by a cork, attached to the mane.

The patient is fed through the tube with milk, hay-tea and boiled oats, strained.

W. R. D.

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[**The Horse Trade in Switzerland.** Ramelet, Col. Dr. A. L. *Schweiz. Arch. f. Tierhlk.* (1933). Vol. 75, No. 3. (Orig. in French).]

This is a long and detailed account of the indigenous and imported horses used for various purposes in Switzerland. Past attempts to breed an indigenous type for use in Alpine country have not been completely successful, and the best breed at present being developed is the Jura breed, which, however, has in recent decades received an admixture of Oriental and Western European blood.

The author discusses the conformation of the type of horse likely to be most suitable for Swiss country, and also the desirable points of breeds of countries bordering on Switzerland. Most of the draught horse breeds of Germany, France, etc., such as the East Prussian Trakehmer, the Mecklemburg, Holstein, Belgian, Percheron, etc., are more suitable for flat, heavy country than for Alpine country.

Apart from breeding an indigenous race, there remains the policy of importing horses of the numerous European, including British, breeds, for definite use in particular districts of Switzerland. This is done at the present time to a large extent, the travelling dealers having become very skilful in judging suitable animals. The author describes Swiss horse-dealing practice in detail. Acclimatisation is an important matter: in this respect it is stated that horses imported from southern European countries are generally more resistant to infections contracted on arrival in Switzerland than those from elsewhere.

Most Swiss cantons have a horse breeding society, 15 of them concerned with saddle horses and 59 with draught horses: these societies are State-aided by the premium system.

The paper is concluded with a system of examination for soundness not differing markedly from the system taught in this country.

J. E.

Report

COUNTY OF LANARK

County Veterinary Officer's Report for the Year 1932

No one interested in the public health veterinary services can afford to ignore anything from the pen of Mr. Hugh Begg, Chief Veterinary Officer, County of Lanark, and his report under the Milk and Dairies (Scotland) Act, 1914, for the year 1932 is no exception. Readers who have not studied his previous reports should consult those referred to in the present one, as in certain parts he has curtailed his usual discussions and given the statistics for 1932 in support of his previous writings. The report, reviewed *in toto*, is compiled in a very concise form, which makes reference very easy and useful and clearly records work carried out in a comprehensive and conscientious manner.

There has been a marked decrease in the outbreaks of anthrax in Lanark during the past 21 years but, though the methods of diagnosis, disposal, etc., there are almost ideal, this reason, the reviewer thinks, accounts for only a certain proportion of the decrease. Credit must be given to both the operation of a local Order, which compels stock owners to report the sudden death of any bovine animal, and also to the economic position of agriculture, resulting in the restricted use of imported foodstuffs and bone manure. Mr. Begg's remarks on the position of the milk market are interesting, but from them it would appear that the contracts arranged by the Lanarkshire producers are not worth the paper they are written on, as, in other parts of the country, at the beginning of any year, a definite price is usually arranged for a stated quantity summer and winter, the question of surplus, however, being entirely in the hands of the purchaser. Mr. Begg suggests a concerted plan of decreased production, but this seems very undesirable, and there is no doubt that the question of surplus milk should be tackled by increasing consumption (also suggested by Mr. Begg) and by an improvement in the methods of handling and manufacturing surplus milk, both aspects, one is afraid, having been neglected by the creameries in the past. In the opinion of the reviewer, the acute position as regards the price of surplus milk in Lanarkshire has not been brought about so much by the increased production in that area, as by the chaotic state of affairs in the cheese-producing counties some distance away.

Twenty-one notifications were received from local authorities stating that *B. tuberculosis* was present in samples of milk, and it would have

been instructive if Mr. Begg had given the percentage of infected samples. His remarks with regard to the examination of the incriminated herds are very instructive, and special attention should be paid to the final paragraph directing attention to the possibility of samples becoming infected by excretions other than milk, as there is no doubt that failure to realise this has often caused unnecessary work, when the examination of a herd, following a positive biological result, did not reveal any cases of tuberculous mastitis. Mr. Begg's discussion on this subject, when considered with the figures in Table 4, giving the number of cows slaughtered owing to tuberculosis of the udder, shows very clearly that as a safeguard to public health, frequent herd examination is the ideal to be aimed at, using the biological test as a corollary. The statistics show that 128 cows were slaughtered and found to be suffering from tuberculosis of the udder, and that 104 of these were found at herd inspections. Against this it should be noted that the cities of Glasgow, Edinburgh, Dundee and Aberdeen have been pursuing an intensive biological examination of bulk milk, resulting in only 21 positive samples in Lanarkshire, which revealed, on examining the herds, eleven cases of tuberculosis of the udder, one case giving tuberculous milk and one case showing chronic cough, though in each of two of the farms cases of udder tuberculosis, and from a third a case of chronic cough, had been removed before the notifications were received. Mr. Begg draws attention very clearly, in parts of his report, to details in connection with public health work, which are often missed or ignored, *e.g.*, he condemns many farmers for their carelessness in not bringing " heifers-in-calf " forward to the calving in good condition. He also states that within the past 20 years 636 herds have been known to harbour contagious abortion, and there was *acknowledged* existence in 72 herds during the past year, yet he does not hear of cases of " undulant fever " resulting from the consumption of milk from aborting cows.

It is rather surprising that in a progressive county like Lanark, the County Veterinary Inspector is not also Inspector of Meat, and in the case of cows slaughtered under the Order there is definite overlapping when both the Veterinary Inspector and the Meat Inspector have to visit to examine the same carcasses.

The record of herds which are tuberculin tested under the Milk (Special Designations) Order (Scotland), 1930, is very encouraging to those who advocate that the question of bovine tuberculosis should be tackled properly, especially when Mr. Begg states that out of 48 such herds 29 are only tested once a year, indicating that each of these herds has not had a reactor for at least two successive six-monthly tests. The reactor average of 1·8 per herd per annum is undoubtedly good, especially when it is noted that one herd was heavily reinfected, owing to the owner's misguided policy of purchasing animals in the open market, without any previous history. One might criticise Mr. Begg's estimation of the number of gallons of " tuberculin tested " milk produced during the year as being too low for herds such as are licensed under this Order.

The tables at the end of the report are very clear, and the only suggestion that might be made is that figures for previous years, or for a group of years, might be given for comparison, as these would no doubt show a progressive improvement in the veterinary public health services under the Act.

F. A. D.

SOCIETY OF MEDICAL OFFICERS OF HEALTH

MEETING OF THE VETERINARY GROUP OF THE YORKSHIRE BRANCH*

A meeting of the above Group was held in the Public Health Department, Leeds, by kind permission of Dr. Jervis, Medical Officer of Health for Leeds, on Friday, April 28th, 1933, at 2.30 p.m., the chair being occupied by Mr. Rabagliati.

The minutes of the previous meeting were read and confirmed and, as there was no special correspondence, the Chairman called on Mr. W. Halstead, M.R.C.V.S., D.V.S.M., to open a discussion on "The Milk Reorganisation Scheme."

Mr. Halstead showed how the whole Report was prepared in accordance with the Agricultural Marketing Act of 1931, and then proceeded to summarise its most important features, economic and otherwise. He pointed out that the Report was prepared primarily to enable milk to be marketed at an economic price, and that this could only be done if there was adequate control of the so-called " surplus " milk. The reduction of this surplus could, to an appreciable extent, be brought about if there was sufficient public confidence in the quality and freedom from pathogenic organisms of milk to ensure an increased consumption.

For this reason the more adequate and closer veterinary supervision of dairy herds was strongly urged.

After a discussion, in which several members took part, and Mr. Halstead had been thanked for his most instructive address, the meeting terminated.

T. W. MacGregor, *Hon. Secretary.*

* Received for publication, June 9th.

ALLEGED POISONING OF CATTLE BY SEWAGE

Bastin and Young *versus* Godstone Rural District Council

APPEAL COURT JUDGMENTS

(*Continued from Page* 650.)

Mr. A. GLOVER, M.R.C.V.S., of Bywell, South Godstone, examined by Mr. Norman Birkett, said that he inspected Mr. Bastin's herd, as Inspector under the Act of Parliament, when the Milk Bill was passed. He first attended them as Mr. Bastin's veterinary surgeon in 1912; in that capacity he was last amongst his cows in 1927. During the whole of that time Mr. Bastin made no complaint that his cows were suffering from sewage poisoning. As a veterinary surgeon he had been attending Mr. Young's cows for a good many years; the last time he was called in to his cows was in 1927, for actinomycosis.

His first inspection of Mr. Bastin's herd was in January, 1928, and he reported "Physical condition healthy, but very poor." On May 25th, 1928, he made another inspection, and another on August 17th, and on these occasions he reported "physical condition good, cleanliness good."

He first visited Mr. Young's herd as an inspector on January 5th, 1928; next on August 27th, and again on December 17th. The reports were "Physical condition fair, very dirty, hind quarters and flanks caked with manure."

Cross-examined by Mr. FLOWERS: When he last saw these herds, neither Mr. Bastin nor Mr. Young consulted him about what their cows were suffering from. They did not show any symptoms of disease. He would have had to report if he had seen evidence of tuberculosis. In his experience, recovery from Johne's disease was very rare, if, in fact, they did recover at all.

In witness's opinion, two gallons a day was a fair average yield of milk for the whole herd; each should give 700 or 800 gallons a year if they were good cows.

Mr. GEORGE DURRANT, M.R.C.V.S., of Barnard Castle, Durham, said that in 1928 he was one of the veterinary officers of the Surrey County Council. In the course of his work under the Milk and Dairies Act he saw Mr. Young's cattle, first going there on May 25th, 1928. Their condition was good, with the exception of one, suffering from mastitis. He made a further inspection in February, 1929, and reported "There is a great improvement in the cleanliness and condition of the cows on these premises."

In February, 1929, he examined an animal of Mr. Young's under the Tuberculosis Order. In his view the animal was suffering from Johne's disease, and he told Mr. Young so. He did not know what happened to that cow.

Witness spoke of visiting Mr. Bastin's farm, and seeing there cows suffering from tuberculosis and Johne's disease.

Mr. WILFRID RHODES, B.SC., M.R.C.V.S., of Reigate Hill, Veterinary Inspector to the Surrey County Council, said his district included the plaintiffs' farms. He did not concern himself with the water supply or feeding of the cows. His duty was to examine the cows' udders under the County Council's order.

In October, 1929, he inspected Mr. Bastin's farm, and found he had 25 cows, with twelve in milk. He next made an inspection in January, 1930, and found 25 cows, of which 15 were in milk. Some of the cows were dirty. In April, 1930, he paid a further visit, when there were 26 cows, of which 22 were in milk. He made a report that some of the cows were in a poor state and dirty. In July, 1930, he was at Mr. Bastin's farm again, and the last time was in April, 1931, when 20 cows were in milk out of 22. This year he found, on a surprise visit, 19 out of 28 cows in milk.

Mr. FLOWERS: Mr. Bastin was never asked about this matter.

Mr. FORTUNE: I thought it my duty to put these reports before the Court.

By Mr. FORTUNE: In witness's opinion, the herd had improved a great deal in condition at the time of his last visit.

Mr. G. M. VINCENT, M.R.C.V.S., of Sutton, spoke to inspecting, as Inspector of the Surrey County Council, Mr. Young's cattle on January 25th, 1928, while they were in the sheds. Their condition was only fair; he found no evidence of the existence of any of the scheduled diseases.

Dr. JOHN FOSTER BEALE, Analyst, spoke of analyses of samples of the effluent from the brook which he had made. He found that 90 per cent. of the samples were satisfactory, but some on certain occasions showed slight deterioration. The variations were extremely slight.

His LORDSHIP: I should have thought a proper sewage works would have delivered an effluent without variations.

Dr. BEALE said he did not agree that the organisms found in the samples of effluent he took would be dangerous to cattle. The organisms found in the intestinal tract were all common to man, animals, birds and fish.

Mr. FORTUNE was about to ask further questions about the droppings of a cow, when his Lordship asked if it was one of the plaintiffs' cows.

Mr. FORTUNE said it was a cow at the Veterinary College.

His LORDSHIP: This is another interesting scientific inquiry.

Mr. FORTUNE: I thought it might assist your Lordship.

His LORDSHIP: It will not assist me, but I cannot say if it will assist the Court of Appeal.

Dr. BEALE then gave the result of his analysis.

Answering Mr. FLOWERS, he said that if the effluent were eight times diluted and put into the stream it would not cause damage from a physical point of view.

Mr. FLOWERS: To put into a dry stream 60,000 gallons a day, running through farms, is a danger?

Dr. BEALE: It would be quite impossible to construct sewage works to safeguard against such pollution. On my visits this stream was not a polluted stream. I visited the stream in March, 1930, when it was normal; in January, 1932, when it was in flood; in April, 1932, when the flow was normal; and in June and October this year, and I never saw the stream in a condition that I should call polluted.

Mr. W. L. SUTTON, Public Analyst for the Counties of Norfolk and Suffolk, practising at Norwich, who said he had been engaged in the analysis of water and sewage for 30 years, and had investigated many cases of river pollution, spoke of a visit he paid to the Lingfield sewage works, on October 30th, last. He said he inspected the processes of purification, and took samples of the effluent.

Mr. BIRKETT: Have you any criticism to offer of the method of purification you there inspected?

Mr. SUTTON: It struck me as a very up-to-date and efficiently-managed works. He added that

the samples of effluent showed that it was not harmful to cattle, in his opinion.

After another witness had been called, Mr. Birkett said he proposed to tender evidence of one of two witnesses who were sewage farm managers. They would say that dairy cattle used their land without hurt of any kind. He asked if his Lordship would allow that to be done.

His Lordship said the only evidence they could give would be, "I am a sewage farm manager, and I think sewage is the best thing that cows can drink." He could not have illustrations of particular farms.

Mr. Birkett said he suggested that the issue here was, "Does sewage in fact hurt cattle?" It would be relevant to tender the evidence of a man who could say, "I have knowledge of this matter, and in my experience it does no harm."

His Lordship: You can give evidence that sewage does not hurt cattle.

Mr. G. Paul said that from 1926 to 1928 he was the tenant, among other land, of two fields belonging to Mr. Young. They were near the brook, and when the hay was taken off he fed his cattle on them. Since March, 1930, he had been the tenant of the Godstone Rural District Council of 50 acres, and some of the fields adjoined the brook. His cattle drank the effluent that came from the sewage farm, but he never had any trouble with them, and they were not injured in any way.

In cross-examination, he said he usually put the cattle on the fields at the end of July or the beginning of August, but he never put his milking cows there. When asked the reason he said it was too far away.

Mr. G. P. Male, m.r.c.v.s., Veterinary Inspector to the Berks County Council, said he had read the tests made by experts called for the defence, and it was evident to him that Mr. Bastin's herd was heavily infected by Johne's disease. He had also considered the results of the *post-mortem* examination of one of the cows, and, in his opinion, it was obvious that it was infected by the same disease.

Mr. Fortune was taking the witness in detail through the results of the examination when his Lordship said, "I suppose I must take all this down, but it is a thousand miles off what I have to consider."

Mr. Male said, "I can find nothing that would do harm to these cattle in any way from the sewage effluent. I do not think that human sewage is harmful to cattle in the slightest. They can take it with impunity. It is only a few people in the profession who have expressed the opinion that human sewage is harmful. I am speaking from my own experience and experiments."

The summer in question (continued Mr. Male) was a very dry one, and, in his opinion, the cattle suffered from lack of water and food. The stream was dried up, and the animals could only drink from puddles in it. Had they been able to get more sewage effluent they would have been better. He had examined the effluent, and it was quite clear and without odour. Owing to shortage of grass the cattle grazed close to the ground, so picked up intestinal parasites, and, in his opinion, all these factors were responsible for their condition, together with the diseases, tuberculosis and Johne's disease. He had similar losses on other farms where the question of sewage did not arise.

Mr. Alfred Tester, of Rushford Farm, Lingfield, said he had put in-calf cows to graze in fields adjoining the brook. Cows in that condition were susceptible to any poison, but he had never had any trouble of that sort.

The two plaintiffs were recalled to deal with points arising out of the evidence of certain of the witnesses for the defence.

Speech for the Council.

Mr. Norman Birkett, k.c., for the Council, began by saying that if necessary he would invoke the aid of the Public Authorities Protection Act, which would mean that the plaintiffs would only be entitled to damages during a period of six months before the bringing of the action. Dealing first with the claim for an injunction, he submitted that there was no satisfactory evidence that after March, 1926, the Council committed any of the acts complained of. The evidence was quite plain that the sewage works were in proper working order, and were functioning efficiently. There was nothing to show in anything that had been put before his Lordship that the sewage works were improperly worked. Moreover, all through the life of the old sewage works there were no complaints. The first witness spoke of June, 1927, and the old works had been there since 1903.

"For 20 years these old sewage works were going on without one word of complaint from anybody," he said. "At that time there were no purification processes, yet throughout all that time until 1927 there was no claim of any sort."

His Lordship: That does not impress me. I cannot say how the works got worse.

Mr. Birkett said the fact that these cattle got ill and wasted could not be said to be due to the effluent.

His Lordship said supposing that he was satisfied that the animals did deteriorate and there was no explanation, then he must say that it was due to the sewage.

Mr. Birkett said his Lordship had had evidence from two farmers on the stream, Mr. Tester and Mr. Paul, that they had never made any complaints, and he submitted that the evidence was strong on the point that the deterioration was not due to the effluent.

"This is a matter of considerable moment to the Council," he went on. "They have spent a great deal of money upon these works, and they have endeavoured, in the face of great difficulties, to discharge from the works a satisfactory effluent. I submit that the case for an injunction cannot be supported. Upon both heads of the claim the burden of proof is on the plaintiffs, and I say that they have not discharged it."

There was no satisfactory evidence that the herds suffered from sewage poisoning. For all his Lordship had been told, they might have been suffering from any of the diseases that affected dairy herds. There was nothing to help him about it. The one cow that the Council's experts were permitted to examine by the only possible test was found to be suffering from Johne's disease. He said that much of the loss of condition of the cattle might have been due to the drinking of water which they themselves had contaminated. The danger was not from the transmission of disease from the human to the bovine or from the bovine to the human, but from the bovine to the bovine. He referred to the high qualifications of many of the witnesses he had called, and said it would be a strange thing to say that their testimony was untrue. Yet they agreed that disease was not transmitted from the human to the bovine.

His Lordship: It does not follow that human disease is transmitted. What is said is that the contents of the human sewage produced disease in cattle.

Reply for the Plaintiffs

Mr. John Flowers, K.C., in reply, on behalf of the plaintiffs, said he would have to deal with the history of the case, as his opponent, Mr. Birkett, had hardly touched the question of pollution up to the end of 1929. The old sewage works were in existence and functioning until March, 1928. The manager had described them as worn out, and said that they ought to be reconstructed. Therefore, the position was that in 1927 and 1928 the works were in such a state as to prove quite definitely that the chief reason for the new sewage works was to produce a better effluent. The new works did not come up to the standard until December, 1929, so it was quite clear, he contended, that the Council were not providing an effluent which was satisfactory to them until the end of that year. In addition to that, there was the admission by Mr. Paine that the works were not in a satisfactory condition, because if there was not sufficient rain the effluent would not be washed away. In 1927, there was a claim by Mr. Head, a farmer, for damage to his cattle from the poisoning of the water, and the Council paid him £750 damages and costs, and bought some of his land.

Unless the Council realised that they had poisoned the stream and the cows, he could not understand the settlement. The reasons for that settlement were not given, but he (Mr. Flowers) asked his Lordship to draw the inference—the irresistible inference—that the Council knew in 1927 that there was poisoning of the stream and the cows, and that was why they paid out the money. Then there was the claim in the middle of 1929 of Mr. Hobbs, another farmer, at Waterside. The Council were desirous of widening the road, and for that purpose they wanted some of his land. Then, as he understood, Mr. Hobbs alleged that some of his cattle had been poisoned by this stream, and that it was suggested that, instead of Mr. Hobbs making a claim, the Council should purchase his farm at £50 an acre. The result was that without any haggling as to price they bought the whole of the 22 acres at £50 an acre. He asked his Lordship to draw the inference from this that the Council knew that Hobbs had a proper claim against them.

The defence put forward, said Mr. Flowers, was that the pollution of the water was due to things other than the effluent from the Council's sewage works. They suggested, first, that it came from Mr. Gilbert's cesspool, but Mr. Gilbert said that the stench came from the brook, and that his cesspool never overflowed, he having had put in an entirely new drainage system. Then the cesspool at Waterside Cottages was put forward, and three farms which drained into the brook were referred to. And finally there was reference to a milk bottling factory. A great deal of evidence was given about Mr. Bastin's pond, but the pond did not drain into the brook.

Finally he submitted that there was no single piece of evidence worth anything with regard to the pollution of the brook other than that relating to the effluent from the Council's sewage works. The pollution, he declared, was due to the overfeeding of the filters at those works.

Mr. Flowers said both Mr. Birkett and himself joined in thanking his Lordship for the patient hearing he had given to a long and difficult case.

His Lordship said he would take time to consider his judgment, and would deliver it in a few days.

High Court Judgment

Giving judgment on November 17th, Mr. Justice Horridge entered judgment with costs in favour of the plaintiffs. In doing so his Lordship said plaintiffs had established that the damage continued up to November, 1929, when they removed their cattle from the meadows through which the stream flowed. He was satisfied that the effluent continued to contain too much sewage matter until October, 1929.

With regard to a suggestion that the cattle suffered from Johne's disease, his Lordship was satisfied that cattle suffering from that disease rarely recovered, and that the signs of its development were not shown by the plaintiffs' cows. He did not think that the pollution was caused by other means. The cattle suffered the damage owing to the drinking of the polluted effluent turned out from the defendants' sewage works. Plaintiffs were accordingly entitled to damages for the cattle losses, milk losses, grazing losses, and incidental expenditure. To Mr. Bastin he awarded damages totalling £2,008 odd, and to Mr. Young £1,939 odd.

His Lordship also granted the plaintiffs' claim for an injunction to restrain the defendants from discharging an effluent into the stream so as to cause danger to any of the plaintiffs' cattle. Judgment was entered accordingly, the operation of the injunction to be suspended for three months. A stay of execution, pending an appeal, was granted.

Appeal Court Judgments

After an extended hearing of arguments submitted by counsel on appeal, reserved judgments were delivered on June 26th, when, by a majority, the appeal was allowed, with costs, and the injunction discharged. Lords Justices Scrutton and Slesser delivered judgments in favour of the appellants, while Lord Justice Greer's judgment was that the appeal should be dismissed with costs, so far as it was concerned with the plaintiffs' claim for damages, but that the injunction should be discharged.

Following as an extended report of the three judgments:—

Lord Justice Scrutton: On March 3rd, 1930, Bastin and Young, two farmers grazing dairy herds of cattle on the Eden Brook, a small stream flowing in the low-lying agricultural country between Godstone and East Grinstead, issued Writs against the Godstone Rural District Council, who had a sewage farm about a mile upstream above the plaintiffs' lands. The Writ alleged pollution of the stream by sewage from the defendant's sewage farm and claimed an injunction and damages. The case, which took 17 days to hear, was conducted throughout as a claim for actual damage to the plaintiffs' cattle by the defendants' sewage. The cattle were withdrawn from the fields on October 31st, 1929. The defendants' sewage works were completely reconstituted in 1927-1928, after a Local Government Inquiry in December, 1926. The new works began to operate on March 1st, 1928, but were said by the defendants not to be operating to their complete satisfaction till the autumn of 1929. The injunction as to the new works was rather in the nature of a *quia timet* claim; but the damage claimed went back to 1926, though no complaint had been made to the defendants before October, 1929.

At the trial in November, 1932, the Judge below granted an injunction restraining the defendants from causing sewage to flow from their sewage works into the stream so as to cause danger to any cattle of the plaintiffs.

Having dealt with the amounts of damages claimed (which he described as exaggerated) and those awarded by the High Court, the Lord Justice proceeded:

While I shall have to expand my reasons in great, perhaps excessive, detail, I state at once the conclusion I have come to after careful and prolonged consideration of the evidence and analyses and the history of the stream in question and its cattle.

The plaintiffs have to prove to my satisfaction, this being a re-hearing by Statute, that the defendant's effluent can damage and has damaged their cattle. They have not satisfied me that any lack of condition in their cattle is due to the sewage effluent of the defendants. I am inclined to the view that human sewage cannot damage the cattle who drink it; but it is enough to say that the plaintiffs have not satisfied me that it can do such damage. It follows that, in my opinion, the plaintiffs' claim fails and the appeal succeeds.

Further, should I be wrong in this as to the period 1926 to 1929, I am of opinion that the evidence at the trial as to the effluent of the new works which had then been working at full efficiency for nearly three years, did not justify the granting of an injunction against the defendants.

Before dealing in any way with the facts as to liability, there are two general remarks to be made. The defendants' principal defence, supported by what the Judge correctly describes as "very strong scientific evidence," was that human sewage did not, and could not, damage the cattle who drink it. The main reason for this was said to be that there were no elements in human sewage which could produce the diseases to which cattle were subject. This was supported by the allegation that cattle drinking in a stream constantly put into the stream their urine and fæces, which might, and frequently did contain bacilli of cattle diseases, especially of a cattle disease known as Johne's disease, which was said to be very common in this locality. It was further supported by the fact that though numerous sewage farms put human sewage into streams, there is no trace, in veterinary literature or established teaching, of any cattle disease caused by cattle drinking human sewage. It was further supported by the interesting fact that three healthy cows at the time of the trial had, under the supervision of the Research Department of the Royal Veterinary College, been for over a year given, as their only drink, the effluent from the defendants' sewage farm, either neat or in various stages of dilution, and were at the trial in perfect health. This was surprising, if human sewage was dangerous to cattle.

Lastly, a number of highly qualified veterinary surgeons gave it as their opinion, based on their experience and knowledge, that human sewage did not injure cattle drinking it. That this position requires serious consideration is shown by the fact that Mr. Justice Luxmoore, after four days' trial in Russell *v.* Horsham Urban District Council, held, on April 21st, 1931: "I am further satisfied by the evidence that human sewage is not of itself a source of danger to animals, and that to poison animals from drinking water it is necessary that there should be either some chemical or vegetable poison in the water, or that there should be some bacteria present harmful to animals, and that such bacteria are not found in human sewage, only in the excreta of animals." A Jury at Lewes has found the other way. Neither decision, of course, binds this Court, which has to decide on the evidence before it.

The second remark is that the allegation of the above position has to combat an instinctive repulsion from its truth. The idea of drinking human sewage is unpleasant, not to say revolting. Mr. Dier, the veterinary surgeon called by the plaintiffs, who is principally responsible for their claim, said: "I am simple enough to think that if animals drink this muck it is likely to cause them damage." One of the witnesses for the defendants speaks of this feeling as "an aesthetic objection." But if one has to decide the fact whether a particular drink does injure cattle, one must attend to the evidence and the inferences to be scientifically and logically drawn from the proved facts, and not allow one's judgment to be disturbed by such question-begging epithets as "muck."

I deal first with the evidence called by the defendants to establish that human sewage, and in particular, the effluent from their works, which was human sewage plus about an equal amount of subsoil water, did not, and could not, damage cattle. In this connection, in 1912, the Commissioners for Treating and Disposing of Sewage, thought the effluent should be diluted with eight times its bulk of river water, and should contain not more than three parts per 100,000 of suspended matter, and should not take up more than two parts of dissolved oxygen per 100,000 in five days at a temperature of 65° F. One of the plaintiffs' witnesses said that sewage engineers were content with six parts of water to one of effluent. It follows that an effluent which has one part of sewage to one part of subsoil water is much worse than the Commissioners' standard. Yet the Research Department of the Royal Veterinary College had for twelve months before the trial given three healthy cows, as their only drink, the sewage effluent from the defendants' works with an average dilution, in the case of one cow, of one part of water to one part of effluent. The Department had gone further than this. One cow, "Kathleen," in milk for her fourth calf, had drunk 1,824 gallons of undiluted effluent. In the twelve months of this experiment, "Kathleen" had 2,802 gallons of sewage, of which 114 gallons was sewage before it went through the filter beds, and 2,848 gallons of water. Full particulars of the three cows are contained in Document 22, and the evidence of Dr. Minett. At the end of twelve months, that is up to the trial, all the three cows were in perfect health, which is odd if this effluent is dangerous to cows.

I quite appreciate that what is sometimes called a laboratory experiment, is not of much value unless its conditions comply with the actual practice of life. We have recently, in the *Radiovisor* case, rejected laboratory experiments which we thought did not reproduce the conditions of actual working; but in the present case, the cows in the Royal Veterinary College were drinking the alleged noxious effluent with a known dilution of water. The plaintiffs' cows in the fields were drinking the effluent with a much larger dilution of water and with the addition of the noxious matter derived from cattle droppings, which, in a district tainted with Johne's disease, may easily include the bacilli of that disease. The latter cows are said

to be injured by this much diluted effluent polluted from other sources, while the former cows drinking the effluent neat are uninjured. Does this experiment support or negative the view that human sewage is injurious to the cattle drinking it? The principal veterinary witnesses for the plaintiffs, Mr. Levie and Mr. Dier, were, of course, confronted by this experiment and asked how they explained it. Mr. Levie said that cows in stalls would only drink three to six gallons a day, whereas cows in the field would drink ten to 20 gallons a day, and the greater quantity would do the harm. Unfortunately for this explanation, the research experiments recorded that "Kathleen" drank 15 gallons a day. He had no other explanation to offer. Mr. Dier said that in the research experiment the effluent was taken in a bucket, but in the field the cows stood in the water and stirred up the sediment. As the sediment would also include cow fæces and urine, that difference would only make the research experiment more accurate as determining the effect of drinking only human sewage. These were the only attempts to destroy the value of the research experiment, except by stating that there was such an experiment, and, as he says: "The defendants performed an experiment." It is not clear that he appreciated the position of the Research Department of the Royal Veterinary College, who act in the interest of scientific research rather than as expert witnesses to win law cases. The Judge's attitude is indicated, however, by his remark: "If I am satisfied in fact and in truth that a particular thing can poison, all the scientific men in the world would not convince me to the contrary." I hope the learned Judge did not mean that, in considering whether the particular thing alleged to have caused certain symptoms did really cause those symptoms, he would disregard the opinion of all the scientific men in the world that the accused thing could not cause the observed symptoms. The fact here is that the cows suffered from certain symptoms, as the Judge, believing the plaintiffs' evidence, finds. What caused the symptoms is inference and, in my view, the research experiment tends strongly to displace the view that human sewage was the cause.

I propose next shortly to summarise what the Judge describes as the "strong body of scientific evidence" that human sewage cannot damage the cattle who drink it, which he, in spite of its strength, has declined to accept. . . .

I begin with the evidence of the Defendants' experts, limiting it as far as possible to the question whether human sewage can damage cattle, and taking them in the order in which they were called. [His Lordship summarised this evidence, which has been fully reported in our columns.—Ed., *V.R.*]

Proceeding, his Lordship said:

In my opinion, the Judge was right in describing this as a strong body of scientific evidence, and it would be necessary for the plaintiffs, who had to prove that human sewage had damaged their cattle when the cattle had regularly drunk out of the stream into which many cattle had put their excrement in a district where Johne's disease was very prevalent, to produce a strong case to overthrow that strong body of evidence.

The principal evidence upon which the plaintiffs seek to disprove the defendants' contention that human sewage cannot damage cattle is that of Mr. Dier and Mr. Levie.

[This evidence, and that of other evidence for the plaintiffs (reported by us last week) was also summarised by his Lordship.—Ed., *V.R.*]

Continuing, Lord Justice Scrutton said:

I have summarised, I am afraid, at great length, the evidence on each side on the vital question whether human sewage can injure the cows drinking it, and if I have to decide on the evidence in this case a question on which the veterinary profession differ, I think I agree with the conclusion that Mr. Justice Luxmoore came to on the evidence in his case, that human sewage does not damage cows. But it is for the plaintiffs to satisfy me that it did damage their cows.

This being the evidence on the main question whether human sewage can damage cattle drinking it, it is necessary to consider carefully why the learned Judge has come to the conclusion that it did damage these cattle. It is desirable first to appreciate the geographical position. . . .

His Lordship then dealt with this and with the history of alleged sewage pollution in the outfall stream and Eden Brook, which, he said, required consideration.

It will be seen (continued the Lord Justice) that the claim falls into three periods: (1) from the end of 1926 to March, 1928, when the old works alone were operating; (2) from March, 1928, to the spring of 1930, when the new filter beds began to work, though it was not till October-December, 1930, that the managers were completely satisfied; (3) from October-December, 1930, to October, 1932, when at the trial the Judge granted an injunction, though the new works were then, on the defendants' evidence, working satisfactorily.

The complaints to the defendants by Hobbs, Bastin, and Young, occurred in September-October, 1929, the time of the great drought. Head had complained in 1926-1927. The only witness called by the plaintiffs as to the works, Mr. Silcock, raised no objection to their design or construction (they were the best modern practice), but, as stated later, objected to the way they were being worked, which, he thought, was for too short a period each day, or with too much sewage pumped on to the filters per hour. The difference, in his opinion, however, was only between 15,000 gallons per hour, which he thought excessive, and 13,000 gallons per hour, which he would be satisfied with.

As I understand the learned Judge's judgment, it proceeds on findings (1) that from the end of 1926 to the issue of the Writ, in March, 1930, the plaintiffs' cows were suffering from some disease; (2) that as when removed from the stream they recovered, the disease was due to drinking in the stream; (3) that the human sewage in the stream could cause damage to cattle drinking it; (4) that the cattle droppings in the stream did not cause damage to the cattle, as if these droppings had caused disease, probably Johne's disease, the cattle would not have recovered, and all these cows did recover when removed from the stream; (5) that consequently the only remaining cause is the human sewage in the stream; (6) that he is satisfied that up to August, 1932, the date of the Arnaud analyses, there was dangerous human sewage poured into the stream by the defendants.

It is obvious that if the Judge is in error in rejecting the "strong body of scientific evidence" that human sewage does not, and cannot, injure cattle drinking it, a vital step in his reasoning fails. There would remain, if damage were accepted, either no proved cause, or the probability of an error in the Judge's finding that cattle droppings and Johne's disease were not responsible for the real damage.

It must be remembered that it is not in the first instance for the defendants to prove that their effluent did not damage the cattle. The plaintiffs must make a *prima facie* case that the effluent did damage the cattle, before the defendants need give evidence, and if the two sets of evidence leave the matter doubtful the plaintiffs fail in their action.

My view of the various stages of the Judge's argument is as follows: (1) The damage to the herds from the end of 1926 to September-October, 1929, rests entirely on the evidence of Mr. Bastin and Mr. Young; no veterinary surgeon then attending the herds supports them. The County Milk Inspector's reports do not support them. I should myself have felt great difficulty in placing any reliance on Mr. Bastin's evidence, whom the Judge describes as "a most difficult witness," and who is obviously extremely inaccurate in his evidence as to damages. Mr. Young strikes me as more accurate, but as dealing with a herd which was constantly changing. His herd is said to be in better condition than Mr. Bastin's, but it has only drunk at the stream for half the day. I should be prepared to find that the herds were not in good condition, but that their lack of condition was much less than the plaintiffs allege. If the plaintiffs' evidence were accurate, I think there would be complaints and evidence of veterinary surgeons and inspectors long before October, 1929.

Secondly, it is not accurate that when removed from the stream, all the cattle recovered. Four or five (the evidence is doubtful which) of Young's cattle were slaughtered owing to bad condition, that is, sold to the kennels for slaughter as food for the hounds, after his first complaint, without the defendants having any opportunity of seeing their condition on slaughter. I should not accept Bastin's evidence as to identity or condition of individual cows. He was much too inaccurate or inadequate on the subject. (3) I have already stated that I prefer the defendants' evidence and research experiment that drinking human sewage does not injure healthy cows. (4) I think that there is no satisfactory evidence that the cattle droppings in water including bacilli of Johne's and other diseases, cannot, and did not, in this case injure the cattle. Johne's disease is very common in the locality, which is favourable to its development owing to the winter floods which spread cattle discharges over the pasture. Dr. Sheather found bacilli of Johne's disease in 15 of the herd, though in small numbers. Mr. Pugh diagnosed two cases of Johne's disease from a different test. Professor Wooldridge found the bacilli of Johne's disease in the one cow whose *post-mortem* the defendants were permitted to attend, a cow that did not die but was slaughtered for poor condition. The symptoms of alleged sewage poisoning are almost identical with the symptoms of Johne's disease. I think it is established that cows in an advanced stage of Johne's disease rarely recover, but do sometimes. I see no evidence of this as to cows in the early stage of a disease which is admittedly very slow in its operation. (5) In my view, the plaintiffs' evidence has not negatived or extended the probability of cattle sewage being responsible for the condition of the herds.

I have not dealt in detail with the analyses, of which the plaintiffs produced very few, and none in their own drinking places before the issue of the Writ, and the defendants produced a great many, and weekly reports of their Sanitary Inspector. Considering the mass of water in the Eden Brook at the plaintiffs' drinking places during the great part of every year or series of years, I am not satisfied that in the years as a whole the plaintiffs have proved an unsatisfactory effluent from the defendants' works.

If the position is accepted that human sewage cannot damage cattle drinking it, and that, in fact, cattle drinking nothing but the effluent slightly diluted for a year in 1931-1932 were not in fact damaged, any question of an injunction disappears. But if the true view ought to be that in the dry weather of August-October, 1929, when the outfall stream was dry above the effluent, the outfall stream below the effluent did contain something which damaged cattle, which explains the claims by Hobbs, Bastin and Young, made on the recommendation of Mr. Dier, two other questions arise: (1) What is the effect on the claim for injunction that after September, 1929, the new works were in operation? (2) What is the effect on the claim for injunction of a period of exceptionally dry weather which does not give adequate dilution of the effluent by stream water?

First, as to the new works. The Plaintiffs called one witness, Mr. Silcock, who made no complaint of the design or capacity of the works, but only objected to the system of their working, which he said was so fast that the sewage could not be properly purified. . . .

Mr. Silcock, as I understand him, agreed that working at 13,000 gallons an hour to the balancing tank, a reasonably good effluent is being produced, but that working at 15,000 gallons an hour was too fast, and would make a bad effluent. It is this supposed bad effluent that the cattle in the research experiment have been drinking for a year without any prejudicial results.

In my opinion, Mr. Silcock quite fails to prove that any bad working of properly designed works is producing bad effluent; and I accept the evidence of Mr. Easdale, the designer, and the defendants' two expert witnesses, that the working is quite satisfactory.

The question of unusual drought may raise very difficult questions for the Courts, which they have not yet, in my opinion, seriously grappled with. It is common knowledge that almost every ten to twelve years there may come an unusual drought. There was such a year in 1911, another in 1921, and in 1929 there was a ten weeks' drought. The outfall stream went dry, as it did in 1921. Streams which during nearly the whole of ten years supply adequate dilution, through no fault of the sewage authorities fail to supply any dilution at all. To stop the sewage works may cause widespread disease to large communities depending on the works to remove sewage. This position is not peculiar to Lingfield; one of the defendants' witnesses was concerned with a tributary of the Thames where the same thing happened. Putting purified effluent into a stream is now a recognised part of the English public health system. It is not necessary for me to decide anything in the present case; but if, which I do not accept, and damage to cattle was caused during the exceptional drought of 1929 in this district, I should not see any reason for granting an injunction when the drought was over, against the proprietor of a well designed and efficiently worked sewage farm.

I have taken an unusual amount of time in considering this case, and I am afraid I have written a judgment of unusual length, because I am differing from an experienced and careful Judge; but in the result I have come to the conclusion that as the plaintiffs have failed to satisfy me that their cattle have been damaged by the

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defendants' effluent, this appeal must be allowed, the judgment for the plaintiffs set aside, and judgment entered for the defendants with costs here and below.

Lord Justice Greer stated the facts of the appeal and proceeded: The problems involved in this appeal present considerable difficulties. If the evidence given on behalf of the plaintiffs be alone considered, they presented a very strong case in support of their contention that they were entitled to damages on the ground that their cows, or a considerable proportion of their cows, were rendered ill by drinking from the Eden Brook at a time when the Eden Brook was, in fact, being contaminated by liquid sewage coming by the effluent from the defendants' sewage works. But the defendants meet this strong case by a strong case for the defendants. They say that this Court ought to find (1) that it is impossible that an effluent from sewage works dealing with human sewage can damage cows even when it is drunk without any dilution, and (2) that no inference ought to be drawn from the condition of the plaintiffs' cows that they were damaged by drinking polluted water, because taking into account the evidence given on behalf of the defendants the right inference to draw is that such illnesses as the cows suffered from were due to Johne's disease.

In order to understand the strength and weakness of the respective cases it is necessary to state shortly the history of the defendants' Lingfield Sewage Works. We are in a better position than the trial Judge to deal with the earlier history of the sewage works. At one time the fact that the sewage works had been in operation under a less efficient method than that which was put into operation in the year 1928, and that until the year 1926 there were no complaints from any farmers that their cows had been damaged by drinking from the stream, struck me as a very strong point in favour of the defendants. The sewage works were first established in 1903. Many of the farmers who gave evidence had cattle drinking from this stream for a great many years before 1926—in one case for 14 years, and in other cases for shorter but substantial periods. The fact that they suffered no damage while the more primitive method was in operation seemed to me at one time to afford strong evidence in favour of the defendants' proposition that liquid human sewage cannot do cattle any harm, but from a plan produced by consent before us showing the different system in operation before 1928, it is plain that no such inference ought to be drawn. The original method of sewage disposal was by pouring the liquid sewage on to a large area of land through which it filtered partly by direct percolation through the soil, and partly by escaping from land drains before it entered the brook. No doubt there may be more satisfactory modern methods for dealing with sewage, but it may well be that filtering through a considerable area of land is a very satisfactory method for a number of years until the land gets choked, or, to use Mr. Birkett's words "gets sick," but may become more unsatisfactory after that stage has been reached. I can, therefore, draw no inference in favour of the defendants' view from the fact that there were no complaints of sewage poisoning until towards the end of the year 1926.

In support of the plaintiffs' case, six farmers were called who at one time or another watered their cows in this stream. . . .

The evidence, taken together, certainly seems to show that all the cows, belonging to the six farmers, that drank at this stream got badly out of condition, and gave indications that their failing health was due to some violent form of indigestion which prevented their food from doing them any good and caused loss of appetite. It also establishes that when the cattle ceased to drink at the polluted stream they improved, and after they were finally removed, most of them got quite well again. This establishes a very strong *prima facie* case. I should add here that Mr. Justice Horridge accepted both Mr. Bastin and Mr. Young as witnesses of truth, and believed their statements as to what happened to their cows to be correct statements of facts. With such a finding the Court of Appeal, not having seen or heard the witnesses, cannot possibly interfere, but, of course, before the Court comes to any conclusion it has to consider the defendants' case as well as the plaintiffs'. The plaintiffs called a large number of witnesses in order to negative what they knew was going to be the contention of the defendants, that the cows could not be poisoned by human sewage. Mr. Dier, a veterinary surgeon and county inspector, practising at East Grinstead, with an experience of 42 years, gave evidence as the result of his experience that in his judgment the commonly accepted theory that cows cannot be harmed by human sewage is not correct. He once held that view himself, but since 1894, his experience had taught him that there are many cases of cows drinking in brooks polluted by human sewage that cannot be explained otherwise than by attributing the bad condition of such cows to the effect of drinking polluted water. His evidence was criticised by Mr. Birkett on what seemed to me quite inadequate grounds. It was said that he was unable to say whether sheep or pigs could be affected by drinking human sewage. His answer was that he did not know, because sheep drink very little, but he did say that in his experience dogs were affected. His view was strongly supported by Mr. Levie, F.R.C.V.S., in practice at Derby, a witness, the value of whose evidence could be better estimated by the Judge who saw him in the witness-box, than by this Court. He was far from being alone, as the plaintiffs also called a number of practical veterinary surgeons practising in country districts, who agreed with the view expressed by Mr. Dier. Mr. Dier also said that he had made *post-mortem* examinations on several of Mr. Young's cows, and some of Mr. Bastin's cows, and on these examinations he found conditions which his experience enabled him to attribute to the results of sewage poisoning. He also said that none of the cows on which he made *post-mortem* examinations was suffering from Johne's disease. The plaintiffs' witnesses were criticised on the grounds that they could not point out any chemical or bacterial element in the various analyses of the water which they could say was the cause of the disease. Personally I do not attach very much importance to this criticism. Food or water may be injurious even when it contains no specific germ which can be said to cause disease. A combination of chemicals, some known and some unknown, together with a combination of bacteria, may cause a failure of vital functions in cases where an expert may be unable to point to any one element in the composition of the food or water which is the cause of the mischief. Further, I suppose the proverb "One man's meat is another man's poison" may not be without its application to bovine herds. Just as some men can take a bottle of port a day without any injury, others would have a very short

life if they indulged in the same habit. It is to be observed that most of the cows that are stated to have suffered from drinking the polluted water are dairy cows, though according to the case made by the plaintiffs, the polluted water was bad for heifers and bulls as well as for the milking cows.

In order to meet this very strong case made by the plaintiffs, the defendants called a number of expert witnesses of high standing in veterinary pathology, who stated that in their opinion human sewage even when undiluted, does no harm to cattle. Their evidence is, no doubt, entitled to considerable weight, but it is of a negative character, and may be explained by the fact that in all cases within their experience where poisoning by sewage has been alleged, they have been able to find some other cause for the ill condition of the cows they were called upon to deal with, and it may be, as I have said, that in a great many cases cows take no harm from drinking polluted streams, whereas in many other cases cows do take harm. The defendants also said that Mr. Young's cow, on which Professor Wooldridge conducted a *post-mortem*, on March 8th, 1930, suffered from Johne's disease, that the Professor found all the symptoms of Johne's disease, which Mr. Dier says are similar to the symptoms of cows suffering from sewage poisoning, at the *post-mortem*, and that on examination of specimens taken away he found the acid-fast bacilli of Johne's disease. There are many kinds of acid-fast bacilli that have nothing to do with Johne's disease; and I am not prepared necessarily to draw the inference that the cow in question was, in fact, suffering from Johne's disease; still less am I inclined to take the view that all the other cows of Mr. Young and Mr. Bastin that recovered were cows suffering from Johne's disease. There is evidence from the defendants that cows can recover from the early stages of Johne's disease, and even in clinical cases they sometimes recover, but the defendants' witnesses admitted that this rarely happened, and I think it is impossible that the cows which recovered, whether they belonged to Young or Bastin, were suffering from Johne's disease. They were clearly clinical cases, that is to say, cases of cows which were observably seriously ill. It is impossible that they could all have been representatives of the rare cases in which such a condition is followed by recovery.

As I have said, the case made by the plaintiffs was a formidable one. They proved by the evidence of veterinary surgeons practising for long years in country districts, that cows drinking from sewage polluted water became ill under circumstances which satisfied those practical veterinary observers that the only cause to which they could attribute the serious loss of condition they had diagnosed was poisoning by sewage. We must not attach too much importance to the word "poisoning." It is not necessarily used in the technical sense of a chemical or bacterial element that causes a specific disease. If the drinking of water contaminated by human sewage causes severe indigestion resulting in emaciation and lack of condition, it may not, perhaps, be technically accurate to describe the pathological condition as "sewage poisoning." But this is unimportant. The question in the present case is whether it is a reasonable inference from the facts proved at the trial, that the undoubted illness of the plaintiffs' cattle, whether describable as sewage poisoning or as acute indigestion, was caused by drinking water polluted by human sewage. The plaintiffs not only put forward their own case, but by their witnesses met in advance the case they knew was going to be made against them by the defendants. Their experts stated from experience that cows diagnosed as having Johne's disease never recovered. The defendants' witnesses disagreed with this view, but admitted that in clinical cases, that is to say, cases of observable illness, from Johne's disease, recovery was rare. Mr. Bastin stated that the 30 out-of-condition cows that were seen by Mr. Pugh, and whose droppings were analysed by Dr. Sheather, all recovered. It was admitted by the defendants' witnesses that if they were suffering from Johne's disease, this would be very remarkable, as recovery in advanced cases was rare.

The defendants' case was twofold. In the first place, they said human sewage cannot, and does not, affect the health of cows. This they tried to prove in three ways: (1) The opinion of scientific and experienced animal pathologists and veterinary surgeons; (2) the experience of Mr. Tester and Mr. Paul, whose cows at material times drank the water of the Eden Brook, and the experience of witnesses acquainted with cattle on sewage farms; (3) an experiment conducted by Dr. Minett, Head of the Research Department of the Royal Veterinary College, London.

In the second place, they also produced evidence from which they asked the Court to infer that the ill-condition of Young's and Bastin's cows was due to Johne's disease.

With regard to the three branches of the defendants' first contention: (1) I think the trial Judge was entitled to attach more weight to the positive evidence of the experienced general veterinary surgeons called for the plaintiffs than to the negative evidence called for the defendants. Half-a-dozen well-authenticated cases of loss of condition for which no other cause can be found than sewage poisoning are more convincing than scores of cases in which no loss of condition has been reported or found. It may well be that cows, like human beings, differ greatly in their power to resist the evil consequences of a bad diet. It may well be that one cow's meat is another cow's poison. I agree with the learned Judge in attaching more weight to the witnesses who speak from long practical experience of the evil effects of continuous consumption of polluted water, than to the views of theoretical professors who are apt to attach too much importance to accepted views which may have formed the basis of their teaching over a long period of time. (2) With regard to Mr. Tester's evidence . . . I think we do not know enough about Mr. Tester's cattle to draw any conclusive inference from his evidence, except perhaps that dairy cows are more liable to have their digestion seriously disturbed by drinking sewage water than other cows. With regard to Mr. Paul's evidence, it is not very easy to find out exactly what his evidence amounts to. It is clear, however, that his cattle only drank at the stream for a short time each year after the hay was cut, that they had the run of all his fields, two of which contained ponds in which there was sometimes water, that he never grazed dairy cows there, and that he had no cases of Johne's disease. The defendants also adduced evidence that cows feeding on sewage farms remained healthy. In some of the cases it appeared that they were provided with drinking water other than sewage water, though they had access to the latter. They were, in most cases, not dairy cattle. It was impossible to investigate all the facts relating to these cows. It seems to me unsafe to infer from the evidence relating

XUM

to cows on sewage farms that it is impossible that Bastin's and Young's cows can have been made ill by reason of drinking the polluted water of the Eden Brook.

It remains for me to deal with Dr. Minett's experiment with the three Ayrshire cows, "Kathleen," "Noline," and "Blackberry." I do not think it is safe to draw any conclusive inference from an experiment of this kind. It was an experiment on three cows of a particular breed. They were not feeding on grass, but had, in addition to hay, substantial quantities of oats, bran, linseed cake, and cotton cake. Except in the case of "Kathleen," the effluent was diluted by tap water. Only "Kathleen" was tested on undiluted effluent. The effluent was probably better in 1931 than it had been in 1928 and 1929. These cows had none of the stirred up mud which the cows drinking in the stream would have. The experiment is not, in my judgment, sufficient to establish that cows feeding on grass in a meadow cannot suffer from deterioration in health by drinking at a stream polluted by human sewage. Notwithstanding the evidence of Professor Wooldridge, and Dr. Sheather, I am not satisfied that the symptoms of illness in Bastin's and Young's cows, which were advanced cases of illness, could have been due to the bacillus of Johne's disease. Some of them may have had bacillus of Johne's disease, but were not in an advanced state of illness from that cause. If they had been, they could not have recovered. Mr. Bastin and Mr. Young gave evidence, which the Judge believed, that all the 30 cows, the droppings of which were analysed, and alleged to contain the acid-fast bacillus characteristic of Johne's disease, recovered their health. I am satisfied by the evidence that their recovery, if their symptoms were due to Johne's disease, is so improbable as to rule out Johne's disease as an explanation of their unhealthy condition.

On the whole case, recognising that "probability is the very guide of life," and that absolute certainty cannot be expected in litigation, I take the same view as the trial Judge, that the plaintiffs had discharged the onus of proving that their cows suffered damage by drinking at the polluted stream, and no question being raised as to the amount of the damages awarded, I think the possibility of some of the cows having suffered from Johne's disease may be treated as sufficiently discounted in the amount of damages awarded. In my judgment the appeal should be dismissed with costs, so far as it is concerned with the plaintiffs' claim for damages.

I do not think that a judgment in this case can finally determine the scientific problem as to the effect on cattle of watering at streams polluted by human sewage. Before the question can be finally solved with complete certainty, more experiments will require to be made. We can only deal with the questions involved in the present case on the evidence given in the case. This evidence sufficiently satisfies me that the plaintiffs have established a high degree of probability that their cows were made ill by drinking from the water of a stream polluted by the defendants' sewage.

I agree, however, that the injunction should be discharged. I think the effluent has been sufficiently improved as to be practically innocuous when it receives the normal dilution.

Lord Justice Slesser following an opening statement, said: The defendant Council say first, that they have not caused noxious matter to flow into the stream, and, secondly, that in any event, such sewage effluent as has passed into the stream is incapable of endangering cattle.

The burden of proving both these contentions is upon the plaintiffs, and I propose to deal with the second contention at the outset, because, if the plaintiffs have failed to prove that human sewage did poison cattle it is not necessary to enquire whether they have or have not proved that the stream was polluted, nor would there be any test of pollution to be applied. It is either common ground between the parties, or, if not common ground, is found as a fact by the learned Judge upon sufficient evidence, that there was a marked deterioration in the condition of the cows which watered at the stream in question; in the case of the Plaintiff Bastin from the end of 1926, and in the case of the plaintiff Young from the autumn of 1927, and it is only necessary on this head to quote the evidence of the plaintiff that from the end of 1926 to the end of 1929, every summer, when the cows were drinking at the stream they became sick. He said that they had no life in them at all; were not milking, and would not stand to the bull, and generally were emaciated. The plaintiff Young said substantially the same thing, but dated his complaint from the autumn of 1927. Mr. Dier, the veterinary surgeon who was called in to examine the cows, corroborates this evidence. Further, there is evidence of a more general kind that when the cows were removed from the stream they recovered, though, as some of the cattle were slaughtered as a result of their sick condition, this evidence must be read subject to that qualification.

But the mere fact that the cattle became sick when drinking at the stream, and recovered when taken away from it, even assuming that the stream was polluted, as alleged, does not necessarily prove that the pollution was the cause of their sickness. As I have come to a conclusion on this matter which differs from that of the learned Judge, I find it necessary in courtesy shortly to summarise my reasons. I say shortly, because after the detailed examination of the evidence which appears in the judgment of Lord Justice Scrutton, and the conclusions by him arrived at, as I find myself in substantial agreement with those conclusions, it does not become necessary for me to repeat them in any detail.

As I have said, it is incumbent upon the plaintiffs to prove their case, and this they sought to do by the following means: First, they called evidence to the effect that the cattle sickened when drinking these waters and recovered when taken away from them. This leaves open the question whether there might not be in the water some malignant quality other than the sewage effluent. There is a disease which affects cattle, and affected some, at any rate, of these cattle, known as Johne's disease, and, to the suggestion which is made by the defendants that these cattle were infected at the stream by the excrement of other cattle suffering from this disease, the plaintiffs answer that veterinary evidence goes to show that cattle suffering from Johne's disease in what they call the clinical stage, in which stage they say that these cattle were, do not recover, and that, therefore, they cannot have been so suffering. According to Mr. Dier, the plaintiffs' veterinary surgeon, the symptoms of cows suffering from Johne's disease and sewage poisoning are very similar.

Secondly, they called positive evidence of veterinary experts to say that cattle can be harmed by human sewage. It appears from the evidence of Mr. Dier that there is a commonly accepted theory that cows cannot be harmed by

human sewage. This view, he says, is not correct, though, at one time he thought it was. A Mr. Levie, a Fellow of the Royal College of Veterinary Surgeons, agreed with Mr. Dier, and so did some other practical veterinary surgeons. To give the reasons why their evidence does not satisfy me would be to repeat what has been said by Lord Justice Scrutton, for I have come to the same conclusion that he has, that such evidence is insufficient, in the light of the contrary evidence, both theoretical and practical, given by the defendants, to establish the plaintiffs' proposition.

I pass, therefore, to the defendants' evidence, which falls into four classes. First, the opinions of their experts, both scientific and practical; secondly, the experience of other persons who have had cattle either drinking at this stream or sewage farms; thirdly, practical experiments of feeding cattle with this effluent by Dr. Minett at the Royal Veterinary College, London, and fourthly, the suggestion which I have mentioned, that these cattle were infected with Johne's disease.

As to the first contention: again, I can do no more than repeat what has been said by Lord Justice Scrutton as to the weight and authority to be attached to the evidence of the defendants' expert witnesses who represent, in substance, the preponderating views of their profession. Without in any way belittling the qualifications of the plaintiffs' experts, I cannot but be impressed by the inferiority of their status and authority compared with that of the defendants', among whose witnesses were many with practical experience as well as theoretical.

Secondly, there is the evidence that cows feeding on several sewage farms have remained healthy. Such evidence appears to me highly corroborative of the defendants' case. If their view be right that Johne's disease is prevalent among the cattle around this stream, the fact that Mr. Head and Mr. Hobbs' cattle suffered from sickness while drinking at this stream would not discount the experience from other sewage farms that cattle feeding on sewage who had not got Johne's disease were healthy. In addition, there is the evidence of Messrs. Paul and Tester, that their cattle drank from this stream and remained healthy. The position of the various drinking places of these different farms has been explained, and if the sewage did have the effect ascribed to it by the plaintiffs, it is very remarkable that the cows of Messrs. Paul and Tester escaped all injury.

Thirdly, there is the experiment upon the three cows recited by Dr. Minett. It was sought to say that this was a mere laboratory experiment; but as I understand the evidence, these cattle were subjected to an effluent more potent, at any rate, in the case of the cow "Kathleen," than the waters in the brook at the drinking places of the plaintiffs, and is a very searching test, added to the proved continued health of the cattle at the sewage farms, disproving the plaintiffs' case.

Lastly, as to Johne's disease. It is said, first of all, that of recent years the power of recovery of the cattle from this disease has been recognised, more particularly their recuperative possibilities in the early stages of the disease. The recovery of some of these cows would, therefore, not be conclusive that Johne's disease was not existent in the herd. In fact, there is no doubt that many of these cows had in them the microbes of Johne's disease. Thus, Dr. Sheather reports: "The examination of 37 samples shew bacilli with the character of the bacillus of Johne's disease in 15 cases, though not present in large numbers." This was on April 7th, 1930, and the examination after death of a cow by Professor Wooldridge, on March 8th, 1930, also disclosed the bacillus and symptoms of Johne's disease. Mr. Pugh also discovered such symptoms. Johne's disease was prevalent in the area.

In all the circumstances, in my view, the defendants' absolute denial of the possibility of pollution by human sewage poisoning cattle is given great support by the evidence, but it is not necessary for the defendants in this case to go so far: it is enough for them to say that the plaintiffs have not made out their case, and for the reasons stated by Lord Justice Scrutton, I think it right to hold that the plaintiffs have failed.

This is a rehearing, and it is not one of those cases where we are not as well able to come to a conclusion on this difficult matter, which is chiefly one of inference, as the learned Judge. I have accepted his finding generally as to the condition of the cattle, and as to the factual evidence of Mr. Bastin and Mr. Young. The rest is largely a matter as assumption on a difficult scientific question on which I have come to a conclusion adverse to the plaintiffs, after having read the whole of the shorthand notes and all the other relevant evidence in the case.

I do not think it necessary in these circumstances to discuss in detail the further contention of the plaintiffs that at all material times the stream was polluted in greater or lesser measure with human sewage, beyond saying that I am not prepared to differ from the view of the learned Judge, that the stream at time was in varying degrees of pollution—indeed, in February, 1927, the defendants' Drainage Committee refer to the sewage in the stream as an evil needing mitigation; though I think that the evidence shews that, except perhaps in the period from August, 1929, to October, 1929, when there was an exceptional drought, the proportion of effluent to pure stream water, at any rate, below the confluence of the Eden Brook and the Felcourt Stream, was considerably less than the plaintiffs suggested. I attach, however, little importance as to the exact proportion of pollution; and for this reason, that although in an action for nuisance it might be very material to show that the percentage of pollution was within a reasonable amount—a test of reasonableness being afforded by the proportions suggested by the Royal Commission—if it were the fact that human sewage here had poisoned cattle, there is evidence of considerable human sewage at times having been poured into this effluent, and I doubt if the defendants could escape, even on their own figures, by showing merely that the proportion of effluent was not as large as that for which the plaintiffs contended. Of course, there might be cases where the amount of effluent was so small or the source of pollution so remote from the areas of contamination that it might be said that even if human sewage could poison cattle the amount was so small that it could not have any deleterious effect, but that is not the case here.

To make the grounds of my judgment clear, I would say, therefore, in conclusion, that this appeal should be allowed solely on the ground that the plaintiffs have failed to show that the effluent, however much or little human sewage was in it, has poisoned their cattle.

In any event there is no such evidence of continuing of pollution as to justify such a drastic remedy as an injunction.

Mr. Norman Birkett: My Lord, in the result the appeal will be allowed with costs here and below and the judgment on damages and injunction discharged?

Lord Justice Scrutton: Yes.

Notes and News

The Editor will be glad to receive items of professional interest for inclusion in these columns.

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DIARY OF EVENTS

July 17th.—Meeting of the Editorial Committee, N.V.M.A., at 2, Verulam Buildings, Gray's Inn, W.C.1, at 4.30 p.m.

July 21st.—Summer Meeting of the Mid-West and South Wales Division, N.V.M.A., at Monmouth.

July 21st.—Summer Meeting of the Central Division, N.V.M.A., at Chelmsford.

July 21st.—Summer Meeting of the Eastern Counties Division, N.V.M.A., at Great Yarmouth.

Sept. 18th-23rd.—N.V.M.A. Congress, Llandudno.

Sept. 25th-26th.—R.C.V.S. Jubilee Memorial

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ROYAL COLLEGE OF VETERINARY SURGEONS

Professor Gaiger Elected President

The Council of the Royal College of Veterinary Surgeons, at a special meeting held in London on Thursday of last week (a full report of which will appear in an early issue) elected Professor S. H. Gaiger, F.R.C.V.S., Professor of Veterinary Pathology and Bacteriology at the University of Liverpool, President of the College for the ensuing year.

Professor Gaiger was appointed at Liverpool University, in 1925, to the William Prescott Chair of the Care of Animals, Causation and Prevention of Disease. Educated at the Royal High School, Edinburgh, he qualified M.R.C.V.S. in 1905, and later held the posts of Director of the Animal Diseases Research Institute (Scotland) and Research Professor in Animal Pathology in the Royal (Dick) Veterinary College, Edinburgh. He has served as a member of the Foot-and-Mouth Disease Research Committee since its inception.

Professor Gaiger has a wide experience of animal contagious diseases, and has travelled extensively in this connection, including a visit to the Argentine in 1928 at the invitation of the Argentine Government. Some years previously to this he undertook a mission to Peru to investigate a disease of sheep in the Peruvian Andes.

In 1925 the Royal College of Veterinary Surgeons awarded him the Steel Medal for veterinary research. Last month he was elected a member of the newly-constituted Veterinary Council of the People's League of Health, set up in view of the recent investigation into the relation of tuberculosis to the milk supply.

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R.C.V.S. OBITUARY

Beeson, Stephen, "Arnwood," Ledbury Road, Hereford. Graduated London April 17th, 1872. Died July 3rd, 1933. Aged 84 years.

Rylands, Dan. Harrison, Municipal V.S., Colombo, Ceylon, Captain, R.A.V.C. (T.F.) (retd.). Graduated London, December 20th, 1907. Died May 28th, 1933. Aged 48 years.

The Late Captain Dan. Rylands

A colleague of the late Captain Rylands, who writes from the Government Veterinary Surgeons' Office, Colombo, states that the latter died in Colombo after a very short illness. He arrived in Colombo less than three years ago, to take up the post of Veterinary Surgeon to the Colombo Municipal Council, and would have been due shortly to proceed to England on leave. An exceedingly sad feature is that Captain Ryland's wife, with whom much sympathy will be felt, had preceded him on leave a few weeks before, leaving him in his usual good health.

The deceased gentleman, during his short stay in Colombo, had made himself very popular with all classes, and there was a large attendance at the interment to pay a tribute of respect and affection. Captain Rylands had a wide circle of friends in the profession, to whom the news of his unexpected death will come as a shock.

Captain Rylands obtained a commission in the R.A.V.C. (T.F.) on the outbreak of the Great War, in August, 1914. He served in Egypt and Palestine from 1915-1919, where he commanded 1/4 North Midland Mobile Veterinary Section with the 2nd Mounted Division. He was attached to the Royal Air Force in Egypt during part of his time, and was a qualified pilot—probably the only officer of the R.A.V.C. who was a qualified pilot in the Royal Air Force.

He retired from the Army with the rank of captain.

He held an important appointment in Demerara, British Guiana, from 1921 to 1924, and was in practice at Bawtry, Yorkshire, until leaving for Ceylon in 1930.

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PERSONAL

Marriage.—Corrigall-Harvey.—At the Station Hotel, Perth, on July 1st, 1933, by the Rev. Andrew Campbell, M.A., assisted by the Rev. Peter Young, M.A., Ernest R. Corrigall, M.R.C.V.S., D.V.S.M., youngest son of the late William Corrigall and of Mrs. Corrigall, Leadketty, Dunning, Perthshire, to Alice Carter Crawford, only daughter of Mr. and Mrs. George Harvey, Pretoria House, Crieff, Perthshire.

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VETERINARY INSPECTION IN CHESHIRE

At a recent meeting of the Milk and Dairies Committee of the Cheshire County Council, the question of appointing full-time veterinary surgeons for Cheshire was considered.

It was decided to recommend to the Cheshire County Council that the following five veterinary

surgeons be appointed full-time officers for the county: Mr. George McKee, of Nantwich; Mr. J. T. Taylor, of Winsford; Mr. J. F. B. Garside, of Congleton; Mr. T. D. Lloyd Jones, of Dorset; and Mr. E. A. Comer, of Birmingham.

Originally there were 41 applications, and the final recommendations were made from a list of 15.

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INFLUENZA RESEARCH: AN IMPORTANT ADVANCE

An important step towards the elucidation of human influenza has been taken, in that it has now been found that ferrets are susceptible to infection from material from influenza-infected subjects—it will be remembered that the successful study of dog distemper and the discovery of immunising agents against that disease were made possible by the circumstance that ferrets can be infected with the virus.

This development in influenza research has been the work of Dr. P. P. Laidlaw, Dr. Wilson Smith, and Dr. C. H. Andrewes, of the National Institute for Medical Research Farm Laboratories, Mill Hill, the centre at which Dr. Laidlaw and Major G. W. Dunkin conducted the brilliant investigation into canine distemper, which undoubtedly paved the way for this advance in the study of human influenza.

A considered account, by the above authors, appears in the current issue of the *Lancet,* of the evidence on which this new advance is based. There would appear to be some points of similarity between the influenza virus described and that of swine influenza, as described by Schope, in America, an abstract of which information we hope to publish in the near future.

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ARMY VETERINARY SERVICE

London Gazette — War Office — Territorial Army.

July 7th.—Lieut. F. J. L. Croudace to be Captain (April 6th).

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LIVERPOOL EXAMINATION LIST

The following is the University of Liverpool, School of Veterinary Science, Examination List for June, 1933, in connection with the University Degrees of M.V.Sc., and B.V.Sc.:—

Degree of M.V.Sc.

Sidhom, N. B.

Degree of B.V.Sc.

Final Examination: *Part I.*—Baird, J. C.

Third Examination: *Part I.*—Edwards, G. B., Hey, T. E., Marginson, J. C., 1. 2. Patchett, Edith H. *Part II.*—Edwards, G. B., Hey, T. E., Patchett, Edith H. *Part III.*—Edwards, G. B., Hey, T. E.

First Examination: *Part I.*—Kieran, H., 3. 4. Ormerod, Miriam R., Shirley, G., Tutton, E. A., Young, S. C. *Part II.*—Ellison, Kathleen P., Jones, S., Kieran, H., Ormerod, Miriam R., Shirley, G., Tutton, E. A.

1.=Distinction in Veterinary Hygiene and Dietetics.
2.=Distinction in Genetics.
3.=Distinction in Physics.
4.=Distinction in Chemistry.

Correspondence

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

All correspondence must bear the name and address of the contributor for publication.

The Editor does not hold himself responsible for the opinions of his correspondents.

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TREATMENT OF "SCIRRHOUS CORD"

To the Editor of the Veterinary Record.

Sir,—In reply to Mr. Llewelyn-Jones' query regarding the non-surgical treatment of scirrhous cord, about 18 months ago I treated a case, where the owner would not consent to the radical operation, with intramuscular (gluteal) injections of Contramine, and S.U.P. 468. Both these preparations are made by the British Drug Houses, London, and are obtainable either from them, or through any of the wholesale houses. Contramine, in dosage of 2 c.c., was injected once a week, and S.U.P. 468, in dosage of 5 c.c., twice a week, for about six weeks. Potassium iodide was also given internally. It was a case, accompanied by a fair amount of purulent discharge through a scrotal wound (castration), that had never healed, and which disappeared for a period, only to return again, and there was marked stiffness of the hind quarters. Recovery was complete, and has been maintained.

Yours faithfully,
J. F. D. Tutt, f.r.c.v.s.

Winchester,
July 6th, 1933.

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ALLEGED POISONING OF CATTLE BY SEWAGE

To the Editor of the Veterinary Record.

Sir,—May I be permitted to make one or two corrections in the report of the case Bastin and Young *v.* Godstone R.D.C., in your issue of July 8th, with reference to the evidence given by myself.

On page 646, column 2, lines 30 and 31, in reference to Johne's bacilli and tubercle bacilli. I am reported to have stated that "neither of these organisms was present in *animal* sewage." (italics mine). It is not possible after this long interval—the case having been heard in October and November of last year— to recall the exact words used, but it is obvious to me that the word "animal" should read "human" sewage. If the word "animal" is to stand then it should read "*healthy* animal sewage," since everybody knows that both organisms may be present in excreta of animals affected with these diseases.

The first word in column 1, page 647, should read "of" not "or."

In the last paragraph, column 1, page 647, I am reported to have stated, with reference to milk yields, that the yield was reduced during the lactation period "until at the end of about three months she might be giving no milk at all." It should read "at the end for about three months she might be giving no milk at all."

As a rule I do not mind minor errors in reports, but as these errors very materially alter the import of my evidence, I shall be grateful for the opportunity to make the corrections.

Yours faithfully,
Geo. H. Wooldridge.

Royal Veterinary College,
London, N.W.1.
July 8th, 1933.

PASTEUR INSTITUTE
DIAGNOSTIC TUBERCULIN

SUBCUTANEOUS -	4 c.c. (Single bull dose)	**1/-**
	20 c.c. (5 bull doses) -	**3/-**
INTRADERMAL -	1/5th c.c. (1 or 2 doses)	**9d.**
	1 c.c. (5 to 10 doses) -	**2/6**
	5 c.c. (25 to 50 doses) -	**7/3**
AVIAN - - -	10 dose tubes - -	**1/3**

Pasteur Institute Diagnostic Tuberculin is distributed direct to Veterinary Surgeons by Genatosan Ltd., who have taken elaborate precautions to prevent supplies reaching members of the general public. Leaflets are available giving the full technique of use and copies will gladly be sent to any Practitioner who writes to:

THE VETERINARY DEPARTMENT

GENATOSAN LTD

LOUGHBOROUGH **LEICESTERSHIRE**

Telephone: Loughborough 292 *Telegrams: "Genatosan, Loughborough."*